LITERATURE ON METABOLISM
A BIBLIOMETRIC STUDY

DISSERTATION

Submitted in partial fulfilment of the
Requirements for the award of the Degree of

Master of Library and Information Science

1999 – 2000

By

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Certificate

This is to certify that Ms. Gausia Nayab has completed her dissertation entitled "Literature on Metabolism : A Bibliometric Study" in partial fulfilment of the requirement for the degree of Master of Library and Information Science. She has conducted the work under my supervision and guidance.

I deem it fit for submission.

(Prof. Shabahat Husain)

ACKNOWLEDGEMENT

At first let me express my endless thanks to the Almighty who is our expression for all forces and powers which we do not understand or with which we are unfamiliar.

It gives me immense pleasure to express my deep sense of gratitude and sincere thanks to my respected teacher and Supervisor, Prof. Shabahat Husain, Department of Library and Information Science, A.M.U. Aligarh, for his excellent guidance, sympathetic and motivating attitude throughout the course of this study. I always found him kind enough to spare his valuable time unhasitatingly. I consider myself fortunate enough to have worked under his supervision. My regards, and admiration for him are unbounded. He is the man, whom I adore most.

I owe my immense gratitude to Mr. S. Mustafa, K.Q. Zaidi, Chairman, Department of Library and Information Science, A.M.U. for his inspiring support.

Thanks are due to my respected teachers Mr. Naushad Ali P.M., Ms. Sudharma Haridasan, Mr. Masoom Raza and Ms. Nishat Fatima, Lecturers of the Department of Library and Information Scinece, A.M.U. for their continuous encouragement during my stay in the department.

I also express my thanks to the office and library staff of the Department who have rendered great assistance to me in the collection of material.

My heartful thanks are due to my uncle Dr. Syed Mohd. Amin, Lecturer Deptt. of Urdu and Prof. Akhtar Zaheer Rizvi, Deptt. of Economics, AMU for their continual encouragement during of my student days in Aligarh.

My humble feelings of gratitude are also due to my parents, brother Mr. Altaf Husain and sister Ms. Razia Nayab who have always been the source of strength, inspiration and encouragement to me throughout my life.

I am thankful to my friends Miss Saira Raheem, Mr. Hasan Nawaz Khan and Mr. Nadeem Khan as their collective support, moral backing helped me to continue my study upto the completion of this work.

Dedicated

to my

Grandfather

(Syed Shah Mohd. Mustafa Ali Haider Qalander)

CONTENTS

Chapter - 1

Bibliometrics

BIBLIOMETRICS

1. INTRODUCTION

Information science is a discipline that investigates the properties and behaviour of information, the forces governing the flow of information, and the means for optimal accessibility and usability. It is concerned with that body of knowledge that relates to the organisation, storage, retrieval, interpretation, transmission, transformation and utilization of information. This includes the investigation of information, representation in both natural and artificial systems, the use of codes for efficient message transformation, and study of information processing devices and techniques, such as computers and their programming systems.

Bibliometrics is a relatively new branch of information science. It has been found that quite a good number of articles published in Library and Information Science periodicals are on bibliometrics and its related topics.

Bibliometrics is a new subject, which has emerged as a research front in its own right in Information Science. It is now being vigorously pursued and with the result, it has been found that one fourth of all the articles published in Library and Information Science belong to Bibliometrics. It lies between the border area of the Social Sciences and Physical Sciences.

Bibliometrics has been derived from the two words, 'Biblion' means book and 'Metric' means measurement. The basic units of bibliometrics are all the facets of written communications such as primary and secondary periodicals, articles and abstracts published in them, bibliography of articles, books, monographs and other media of communication.

The term Bibliometrics has very recent origin. It is analogous to Ranganathan's Librametrics, Russian's concept of 'Scientomatrics', FIDs 'Informatrics and also to some other well established sub-disciplines like 'Econometrics', 'Phychometrics', 'Sociometrics' and 'Biometrics'.

We can say that bibliometrics is a methodological sub-discipline of Library science, including the complex of mathematical and statistical methods, used for analysis of scientific documents and non-scientific documents.

2. EMERGENCE OF THE TERM BIBLIOMETRICS

Bibliometrics has emerged as thrust area of research involving researchers from different branches of human knowledge. The term 'Bibliometrics' was coined only in 1969.

The first recorded study on Bibliometrics was done in 1917 by Cole and Eale's study on 'The History of Comparative Anatomy Part – 1 : A Statistical Analysis," for the first time the expression "Statistical Analysis" has been used in the 'Literature.

The second study done by Hulme in '1923' used the expression 'Statistical Bibliography' and later it was used by many others.

Gross & Gross's study is considered to be the third study in the field based on citations in 1927. After Hulme, the term statistical Bibliography was used by Henkle in 1938 in his article "The Periodical Literature of Biochemistry". Pritchard initially used the term 'Statistical Bibliography" in his work but it could be confused with statistics itself or with bibliographies on statistics. Pritchard, therefore, suggested the word 'Bibliometrics' in 1969 in preference to Statistical Bibliography.

3. DEFINITION OF BIBLIOMETRICS

Many attempts have been made to define the term Bibliometrics, as given below :

1. Hulme (1923) : "The purpose of Statistical Bibliography is to shed light on the process of written communication and of the nature and course of development of a discipline by means of counting and analysis its various facets of written communications."

2. Raising (1962) : "The assembling and interpretation of statistics relating to books and periodicals..., to demonstrate historical movements, to determine national and universal research use of books and journals."

3. Pritchard (1969) : "The application of mathematical methods of books and other media of communication."

4. Fairthorne (1969) : "Bibliometrics is the quantitative treatment of properties of recorded discourse and behaviour appertaining to it".

5. British Standard Glossary of Documentation of Terms : "The use of documents and patterns of publications in which mathematical and statistical methods have been applied". This definition is basically similar to Pritchard's original definition.

6. Hawkins (1977) : "Bibliometrics is the quantitative analysis of the bibliographic features of a body of Literature".

7. Potter (1981) : "Bibliometrics is the study and measurement of the publication patterns of all forms of written communication and their authorship".

8. Schrader (1981) : "Bibliometrics is the scientific study of recorded discourse".

9. Broadus : "Bibliometrics is the quantitative study of Physical published units or of bibliographic units of surrogates of either."

10. Sengupta : "Organisation, classification and quantitative evaluation of publication patterns of all macro and micro communications alongwith their authorship by mathematical and statistical calculus."

The term bibliometrics has a very recent origin and is relatively a new branch of information science. It has been found that one fourth of all articles published in Library and Information Science periodicals are on Bibliometrics and its related topics. Recent trends show that Bibliometrics literature cover nearly 25% of the total contributions of Library Science. A sizable portion of bibliometrics literature is based on citation analysis.

4. BIBLIOMETRICS : ITS SCOPE AND APPLICATION

A. Scope

Nicholas and Ritchie in 1978 very "Lucidly elaborated the scope of bibliometrics. They opined that bibliometrics provide information about the structure of knowledge, and how it is communicated." They further added that 'Bibliometric' studies fall mainly into two broad groups :-

a) Those describing the characteristics or features of a Literature (Descriptive Studies)

b) Those examining the relationship formed between components of Literature (Behaviour Studies)

While defining the scope of 'bibliometrics', Doniel Conner and Henry Voos add that the "Scope of bibliometrics includes studying the relationship within the literature (a citation studies) or describing a literature typically these descriptions focus on consistent patterns, involving authors, monographs, journals or subject language." Rolland Stevens considers bibliometrics as a quantitative science and divides it into

two basic categories viz. Descriptive bibliometrics and Evaluative Bibliometrics. He has further divided these two areas into different sub areas as given hereunder –

(a) Descriptive Bibliometrics
   - Geographic
   - Time Period
   - Discipline

(b) Evaluative Bibliometrics
   - Citations count
   - Reference count

Stevens further adds that descriptive bibliometrics includes the "Study of the number of Publications in a given field or productivity of Literature in the field for the purpose of comparing the amounts of research in different countries, the amount produced in different subdivisions of the field. The kind of study is made by a count of the papers, books and other writings in the field or often by a count of these writings which have been abstracted in specialized abstracting journals. The other i.e. evaluative bibliometrics includes the study of the literature used by research workers in a given field. Such

a study is often made by counting the references cited by a large number of research workers in their papers".

B. Applications

Bibliometric techniques are now being consistently used to get factual and accurate data for information handling and transfer. Enumerated below are some of the areas where Bibliometric techniques may be used :-

1) To study quantitative growth of a discipline and its literature quantitatively.

2) To evaluate the quality of research of an individual of an institution or of a country.

3) To assess the research output i.e. productivity study of an individual scientist, an entire organisation or of a country.

4) To undertake sociological studies of science and scientists.

5) To study science of science and scientists.

6) To predict past, present and future of scientific classics.

7) To estimate comprehensiveness of secondary periodicals.

8) To regulate inflow of information and communication.

9) To develop norms of standardization etc.

5. RESEARCH IN BIBLIOMETRICS

Bibliometrics connotes the science of measurement relating to books. The scope of 'biblio' with passage of time got widened to include all types of documents – books, periodicals, patents, standards, thesis and so on. At present the connotation of bibliometrics turns out to be the science of measurement relating to documents. The word measurement means the application of mathematical and statistical techniques to find out growth and scattering of literature in various types of documents, publication of documents by an author, impact of a document and so on. Bibliometrics lies in the border area of social and physical sciences. It is a matter of common experience that for any body of knowledge to

evolve as a subject of study and research, there should be concerted efforts of study and research, to develop the necessary theoretical basis. Gradually, explanations to these theories are made through diligent research work. For this purpose, very often techniques and methodologies are borrowed from the frontier areas which later become part of the new subject.

Bibliometrics have emerged as a research front in its own right. It, alongwith what we want to designate by Librametrics, forms probably the hardest core of Information Science. It has, however, not yet been organized with a formal structure. As should be natural at this stage of development, most of the research studies in bibliometrics are themselves rather soft. These are based on simple counting enumeration and statistical methods.

Its backbone lies in its sound, theoretical foundation most effectively laid by some pioneer like Lotka, Gross, Bradford, Zipf, Brooks, Garfield, Vickery, Hulme, Pritchard and many others and its techniques are capable of throwing light to various complicated

problems faced by information scientists to qualify the process of written communications.

6. LAWS OF BIBLIOMETRICS

Three fundamental laws actually laid the solid foundation of bibliometrics. They are :-

1) Lotka's inverse square law of scientific productivity (1926).

2) Bradford law of Scattering of Scientific papers (1948).

3) Zipf's law of Word Occurrence – (1949).

1. Lotka's Law

This law was put forth by Alfred J. Lotka in 1926. It relates to the productivity of scientists in terms of number of papers published by them. He was interested in determining, "If possible the part which men of different calibre contribute to the progress of science."

Lotka studied the productivity of authors by publication frequency as indicated in Chemical Abstracts

from 1907 to 1916. Similarly, he studied, the name index of 'Auerbach's Geschietftafeln der physik'. It revealed that the productivity of scientists confirmed to inverse square law, such that for every 100 authors contributing one article, 25 will contribute 2 articles, 11 will contribute 3 articles and 6 will contribute 4 articles, and so on. The observed figure for single article authors were 57.9 percent for Chemical Abstract data (6,891 contributors) and 59.2 percent for the Physics data (1,325 contributors).

"The law states that the number of chemists publishing papers is proportional $1/n^2$ in each", resulting in the authorship of a large number of documents by small number of writers.

The original paper of Lotka gave no suggestion to show that this was a universal law with applicability to all branches of knowledge, or even for that matter, to all the branches of science. Subsequent studies have shown that this law is applicable to the subjects of History, Technology, Science, Literature etc.

2. *Zipf's Law*

His law states that "in a long textual matter if words are ranked on the basis of their frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the word".

i.e. $$f \propto \frac{1}{r}$$

or $$f \times r = \text{a constant}$$

He found that by multiplying the numerical value of each rank(r) by its corresponding frequency (*f*) he obtained product (c) which is constant throughout its text.

3. *Bradford's Law*

Of all the Bibliometric Laws, Bradford's Law has received greatest attention in the literature of Library and Information Science. Bradford's law of scattering was promulgated by the British bibliographer Samuel Clement Bradford. Bradford's concern was with the problem of seepage and scattering of articles in primary

journals and their coverage in indexing and abstracting sources.

Much earlier, he described the pattern of scatter of literature in a subject in various periodicals, in a paper on applied Geo-Physics and Lubrication. In this study he found out that 9 journals covered 429 articles and the next 59 journals accounted for 499 articles, in other words first nine journals contributed for one-third of the articles found on the subject, the next 9x9 journals accounted for another one third, and the next 9x9x9 journals for the remaining one third. In other words periodicals can be categorized in three separate groups as under :-

i) Those periodicals which carry four references in a year, in a given subject.

ii) Those which carry between two and four in a year.

iii) Those which carry one or fewer references in a year.

The first group thus becomes the nucleus of periodicals in a subject and necessarily contains more

articles on that subject rather than periodicals that cover articles on related subjects.

On the basis of above study Bradford enunciated "if scientific periodicals are arranged in the order of decreasing productivity of articles on a subject, that may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and succeeding zones will be $1:n:n^2$".

The refinement of law has been made by B.C. Vickery. He found discrepancy between the verbal and graphical representations of Bradford's law. He pointed out that application of the Bradford's law should not only be limited to three zones, but with suitable modification of the value of ratio n, to any number of zones.

SOME OTHER EMPIRICAL LAWS

A) Price's square root, law of scientific productivity

Derek De Solla Price's square root law states "Half of the scientific papers are contributed by the square root of the total number of scientific authors".

B) Garfield Law of concentration

E. Garfield enunciated a law in 1971 which is known as Garfield's Law of concentration. Garfield in his law predicts. "A basic concentration of journals in the common core or Nucleus of all field".

C) Sengupta's Law of Bibliometrics

This law given by Sengupta in 1973, is known as off-setting weight formula for re-marking periodicals to avoid discrimination against new journals which necessarily have few citation credits. This is basically an extension of the Bradford's Law.

7. APPLICATION OF BIBLIOMETRICS

A. Application in Library Management

It has been said that bibliometric studies should ultimately help in the library management. It is true that knowledge of scattering and obsolescence can be utilized in the acquisition and management of stocks. But there is much more scope for investigation as has been shown by A.D.Booth while considering the optimum physical layout of Library when it is desired to minimize the distance to be traveled by the reader for picking up books from shelves. This means books are to be arranged according to their frequency of use. Several interesting geometrical models of stock have been suggested by Booth. It is claimed that frequency – ordered arrangement can lead to increase in efficiency by as much as ten times.

B. Testing of Retrieval Systems

Information workers have been active in finding a technique, which could be used in testing the performance of a retrieval system. The well-known 2x2 contingency table of

the relevant & not relevant, retrieved and not retrieved has been a significant contribution in this area. This has now been further defined by Fairthorne, Swets, Brookes, Robertson and others.

C. Search Strategy

Another related area for Bibliometric investigation is the study of search strategy in automatic information retrieval. A recent study by C.V. Negoita may be mentioned in this connection. In this study retrieval process was considered in geometric terms.

D. Application in Indexing

Bibliometric studies have been made in some other areas of Library and Information work also. Studies have been made to find out the pattern of frequency distribution, of description of a thesaurus and the distribution of indexing terms. Eugenie Fona analyzed the rank frequency distribution on the EURATOM thesaurus. Zipf's Law, essentially a hyperbolic function, was not found suitable for such distribution. On the other hand, an exponential function was found in good agreement with the actual entropy of the

thesaurus. This exponential function may provide a criterion to 'revise' some zones of thesauri. A comparison of the actual distribution of the term group with the calculated optimum distribution can provide an objective measure for evaluating any indexing system with respect to its efficiency as information transmission channel.

Limitation in Application

Though most of the studies tend to support the Bradford distributions, some other researcher could not get satisfactory results. Gross found that the scatter of research papers among physical journals deviated from that predicted by Bradford's Law. Of the fifty bibliographies studied by Chonez, only six followed the law. Therefore, he calls it as pseudo-scientific law.

In case of Lotka's Law, it was found to fit in most cases. However, the value of the index 'n' was found to vary for different group of scientists.

Another problem with Lotka's Law is that it totally ignores the potential authors who have not produced any publication so far. Because of the above limitation the empirical nature of these laws, are generally questioned.

Citation Studies

The common arguments leveled against citation analysis are the following :

1. Negative citation.

2. Too much of Self-citation and in-house citation.

3. Citation given just to dress up the paper.

4. Variation of citation rate during lifetime of paper.

CONCLUSION

Bibliometrics studies have enabled to develop a body of theoretical knowledge and a group of techniques and have facilitated its application for the further growth of knowledge based on bibliographical data. The past work by Lotka, Bradford, and Zipf have been valuable in helping the librarian to assess the patterns of authorship, identifying the core collection and designing the better retrieval systems.

Bibliometric data provide precise and accurate observations particularly in the study of science and scientist. The information scientist makes use of these techniques for

economical and efficient management of his material and services.

Bibliometric techniques has been gaining recognition and importance especially during the past two decades. The results of such studies are increasingly being applied to manage the library and information science resources and services more effectively. The studies of subject literature and their characteristics have also been found useful and helpful in managing the research and development activities in those subject specialities.

Application of bibliometric techniques is found in selecting most important journals in a given field of knowledge. The exponential growth of literature and rapid development of libraries generated several evolutionary studies about effectiveness and efficiency of information services. These studies led to the identification and application of appropriate quantitative measuring technique known as bibliometrics. The obvious use of this technique is to improve bibliographical control, as it is not possible to start efficient services without analysing the size and character of literature.

Chapter - 2

Metabolism : An Introduction

METABOLISM

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METABOLISM

The word "metabolism is derived from a Greek word 'Metabol' which means 'change'. In all living organism, many chemical and physical changes are constantly taking place. The series of changes that a substance undergoes after absorption from the gastrointestinal tract whereby it is used for synthesis of some of the tissue components or is broken down or otherwise altered and eliminated from the body through urine, feces, sweat or respiration, are referred to as the 'intermediate metabolism' or simply as 'metabolism' of the substance. The various biochemical reactions which takes place in the living organism are called metabolic activities or metabolism.

2. TYPES OF METABOLISM

There are two main types of Metabolism

(A) Biological Metabolism

(B) Chemical Metabolism

A. BIOLOGICAL METABOLISM

The biological reactions are of two types :

1. Anabolism
2. Catabolism

1. ANABOLISM

Those biochemical reactions in which simple substances are converted into more complex substance are called anabolic reactions. The process by which it is used in the synthesis of tissue components are referred to as anabolism. These are constructive processes, for example, photosynthesis. Anabolic reactions require energy to be supplied. It is the process in which the damage cells or tissues are repaired inside the body.

2. CATABOLISM

Those biochemical reactions in which complex substances are converted into simple substances are called catabolic reactions. The process by which it is broken down into simpler products are referred to as catbolism. The catabolic reaction liberate energy. The catabolic process are destructive, for example respiration, digestion.

The two sets of reactions balance each other in maintaining constant weight in the normal adults. There is the constant breakdown of the different components of the tissues and a constant re-synthesis so that at any given time the total amount is the same. The energy for the anabolic reactions as well as the energy required for the different activities of the organisms such as conduction of nerve impulses and muscular contraction is supplied by the catabolism of the absorbed food materials. If food is not ingested for a few days, this energy requirement is met by catabolism of tissues leading to a wasting of tissues and loss of weight.

The metabolic process in both anabolic and catabolic direction are finely regulated by nervous and hormonal control.

B. CHEMICAL METABOLISM

The Chemical reactions are of two types :

1. Metabolism of Organic Substances
2. Metabolism of Inorganic Substances

1. METABOLISM OF ORGANIC SUBSTANCES

The organic substance metabolism have to be studied in both animals and plants. These metabolism is divided into following types :

1.1 Animals Metabolism of Organic Substances

1.1.1 Carbohydrate Metabolism

1.1.2 Lipid Metabolism

1.1.3 Protein Metabolism

1.1.4 Porphyrin Metabolism

1.1.1 Carbohydrate Metabolism

Carbohydrate has been ingested in food, it is converted to the monosaccharide glucose and absorbed into the portal blood. Some of the monosaccharides absorbed in small amounts are the hexoses – fructose, galactose and mannose. They are carried by the portal blood to the liver. Liver has the ability to convert all other hexoses to glucose. The surplus glucose is converted to glycogen and stored by the liver. This process is called 'glycogenesis'. Glycogen from muscle also breaks down, but not to glucose. During the breakdown of glycogen, the glucose ester, glucose-6-phosphate, is produced. Hence in the muscle, it is not converted to glucose, but proceeds further in a process called as 'glycolysis' and forms pyruvic acid or lactic acid. The cycle of events which connect up the liver glycogen through blood sugar to muscle glycogen and back through blood lactic acid to liver glycogen is known as the Lori's cycle.

1.1.2 Lipid Metabolism

The metabolism of lipids comprises the metabolism of neutral-fats or triglycerides, phospholipids, sterols and others. The triglyceride compared to carbohydrates and proteins. Further it can be consumed in diet in an almost pure form and can be stored in a body as almost 90% pure fat. The lipid of these tissues is mainly neutral fat. Brain and nervous system in large amounts and all other tissues in smaller amounts contain phospholipids, glycolipids, cholesterol and others. Cholesterol and long chain free fatty acids and phospholipids are absorbed through the portal blood system and reach the liver.

1.1.3 Protein Metabolism

Protein is the structural component of protoplasm and is thus an important constituent of all cells and tissues. Every tissue has its own characteristics proteins. All enzymes and some of the hormones are also proteins. The proteins of plasma play an important role in the normal distribution of

body fluids. Antibodies and the oxygen carrying substance hemoglobin are also proteins.

The amino acids, on absorption from the intestine are taken up from the portal blood partly by the liver and the rest enter the systematic circulation to be taken up by all other tissues. They are utilized for the synthesis of the proteins of the tissues, enzymes and hormones and also provide energy by their break down. The sulfur contained in some of the amino acids and the phosphorus of phosphoproteins are converted to sulfate and phosphate and excreted in urine.

1.1.4 Porphyrin Metabolism

The porphyrins are complex structures consisting of four pyrrole rings united through methylene bridges. The nitrogen of the pyrrole rings can complex with metallic ions like iron and magnesium. They form the prosthetic groups of conjugated proteins – hemoglobin of the mammalian erythrocytes, myoglobin of the muscle, erythrocrurins of the invertebrates, cytochromes and the enzymes catalase and peroxidase and other oxidative enzymes like tryptophan pyrrolase. All contain iron-porphyrins as the prosthetic

groups. Chlorophyll contains magnesium-porphyrin as the prosthetic group.

1.2 Plant Metabolism of Organic Substances

1.2.1 Lipid Metabolism

Lipids are important cultural components of living cells, such as cell membranes. Lipids often equal the amounts of carbohydrates and proteins in organelles and exceed them in many seeds. If the waxes on many tropical leaves are also included, the total amount of lipids is probably equal to at least all the proteins. Lipids, which include fats and oils, are generally found in a combined form with either proteins or carbohydrates or both, the two exceptions being seeds and osmiophilic globules in plastids. The term lipid is broadly used to cover a wide range of heterogeneous, fat-like, organic substances, all of which are insoluble or sparingly soluble in water but freely soluble in non-polar solvents, such as

alcohol, ether and benzene. Examples of such heterogeneous substances are fats and oils, phospholipids, sphingolipids, sterols and waxes. Most lipids are highly complex molecules, but the natural fats and oils which are the most abundant and widely distributed forms of lipids, and which are of central importance and are relatively simpler in structure and chemistry. Lipids owe much of their biological usefulness to the fact that, by virtue of their nonpolymeric form coupled with their soluble character, they can bridge the gap between the water-soluble and water-insoluble phases without a sharp demarcation line. Findings indicate that the nature and functions of various cell membranes which are simply organisations of macromolecules may best be appreciated in terms of the unique solubility properties of lipids.

1.2.2 Protein Metabolism

Proteins, whether viral, bacterial, plant or animal are polymers of twenty different kinds of amino acids. But despite this fundamental gross similarity, no two proteins of a plant or any other organism are structurally and functionally alike. The basis of these differences lies at the

level of the amino acid sequence characteristic of each protein. The differences among proteins are ultimately reflected in character variations between any two organisms or even between different developmental stages of the same organisms. For example, a pea seed germinates and produces a pea plant with a characteristic organization into roots, stem, leaves, and flowers, each associated with a particular function. The biochemical causes of such phenotypic diversities among different organs of the same plant are the proteins, i.e. phenotypic differences are biochemical differences in proteins. Proteins determine these phenotypic variations, the precise sequence of amino acids within a protein distinguishing it from other proteins.

1.2.3 Photorespiration & Glycollate Metabolism

Photo respiration may be defined as the uptake of O2 and release of Co2, associated with glycollate metabolism, which accompanies photosynthetic Co2 fixation under aerobic conditions.

A currently popular definition is : Photorespiration is the light-dependent evolution of Co2, which

accompanies photosynthesis is C3 plants. The term photorespiration is usually restricted to the formation of phosphoglycollate by oxygenation of ribulose – 1, 5 – bisphasphate and the subsequent metabolism of glycollate in the photosynthetic carbon oxidation cycle.

Photorespiration seems to have a direct bearing on the photosynthetic production capacities of various plants. In general the rate of net photosynthesis in many tropical plants is as much as about four times higher than in many temperate plants. Such differences in net photosynthesis seem to depend on whether photorespiration occurs. In fact control of photorespiration can increase productivity in those crop plants possessing the C3 pathway of photosynthesis.

2. METABOLISM OF INORGANIC SUBSTANCES

2.1 Animals Metabolism of Inorganic Substances

2.1.1 Sodium Metabolism

2.1.2 Potassium Metabolism

2.1.3 Chloride Metabolism

2.1.4 Iodine Metabolism

2.1.5 Minerals Metabolism

2.1.1 Sodium Metabolism

The amount of sodium in normal diets varies from 5 to 15 grams 95% of it is excreted through urine.

Sodium is present in bone as well as in soft tissues. But it is the sodium of the body fluids including blood which is metabolically of greatest importance. Adrenal cortical hormones are required for the normal sodium metabolism. In their deficiency there is an increase in the renal excretion of sodium leading to a fall in blood sodium levels. These are said to be due to an increase in aldosterone levels, probably due to its diminished destruction by liver. They may also be seen in cushing's disease. Sodium is considered the backbone of body fluids, because the quality of water in the extra-cellular fluids is regulated by the quantum of sodium in circulation.

2.1.2 Potassium Metabolism

This is the principal caution of the intracellular fluid. About 4 grams of potassium are present in normal diets. Its deficiency is rare. It is present in all tissues. A deficiency of potassium depresses the cardiac muscle. A gross excess also causes depression of cardiac muscle and paralysis of skeletal

muscle. Excretion is mainly through urine. Adrenal cortical hormones influence potassium metabolism in a direction opposite to that of sodium. Hyper function of the adrenal cortex (eg. Cushing's disease) causes increased loss of potassium in urine and decrease in plasma levels. Hypofunction of the adrenals (eg. Addison's disease) and renal failure cause an increase in plasma potassium levels. Loss of potassium from tissues occurs in wasting diseases (Potassium from tissues occurs in wasting diseases (Potassium is lost along with tissue protein) and in severe dehydration. Potassium may be lost in large amounts in severe diarrhoea and vomiting also. Certain diuretics (eg. Acetazolamide or Diamox) also increase its urinary excretion.

2.1.3 Chloride Metabolism

It exists mainly as sodium chloride in blood and plays a role in the water balance, osmotic pressure and PH regulation. It is also necessary for the formation of HCL by the gastric mucosa.

It is taken as sodium chloride mainly and a deficiency or surplus of sodium and chloride occur together. The chloride

content of cerebrospinal fluid is higher than that of plasma on account of the lower protein content.

2.1.4 Iodine Metabolism

Iodine is mainly required for the synthesis of the thyroid hormones. A minimum of 25 microgram is required daily. Sea water has a high iodine content. Hence, vegetables and foods and other fruits obtained from the sea shore contain sufficient amounts of iodine to meet its requirements. But in places located too for inland or at very high altitudes, the iodine content of natural foods is low and has to be supplemented by adding small amounts of iodine to table salt. Food iodine is first converted in to iodine and then absorbed from the intestines. Iodine can also be absorbed from lungs, other mucus membranes and even through the skin. Excretions mainly through the kidney (40-80%). Small amounts are also excreted through bile, saliva, skin, lungs and intestines.

2.1.5 Minerals Metabolism

(a) Magnesium – Magnesium is about one sixth as plentiful in cell as potassium. Magnesium is specially required as a catalyst for many intracellular enzymatic reactions, particularly those related to carbohydrate metabolism.

The extra-cellular fluid magnesium concentration is slight, only 1.8 to 2.5 m. Eq/Litre. Increased extra-cellular concentration of magnesium depresses activity in the nervous system as well as skeletal muscle concentration. The latter effect can be blocked by administration of calcium. Low magnesium concentration causes increased irritability of the nervous system, peripheral vasodilatation, and cardiac arrhythmia, specially after acute myocardial infraction.

(b) Calcium – Calcium is present in the body mainly in the form of calcium phosphate in the bone. Excess quantities of calcium ions in extra-cellular fluids can cause the heart to stop in systole and can act as a mental depressant. At the other extreme, low levels of calcium can cause spontaneous discharge of nerve fibers, resulting in tetany.

(c) Phosphorus – Phosphate is the major anion of intracellular fluids. Phosphate have the ability to combine reversibly with many coenzyme systems and with multiple other compounds that are necessary for operation of the metabolic processes. Many important reactions of phosphate have been catalogued specially in relation to the functions of adenosine triphosphate, adenosine disphosphatic, phosphocreatine, and so forth. Bones contain a tremendous amount of calcium phosphate.

(d) Iron – The function of iron in the body, specially in relation to the formation of hemoglobin. Two thirds of the iron in the body is in the form of hemoglobin, although smaller quantities are present in other forms, specially in the liver and the bone marrow. Electron carriers containing iron are present in the mitochondria of all cells of the body and are essential for most of the oxidation that occurs in the cells. Therefore, iron is absolutely essential both for transport of oxygen to the tissues and for operation of oxidative systems within the tissue cells, without which life would cease within a few seconds.

2.2 Plant Metabolism of Inorganic Substances

2.2.1. Nitrogen Metabolism

2.2.2 Sulfur Metabolism

2.2.3 Oxygen Metabolism and Toxicity

2.2.1 Nitrogen Metabolism

Nitrogen and Sulfur are, like carbon, hydrogen, oxygen and phosphorus, essential constituents of living matter, i.e. no organism can survive in the absence of these elements. Some organisms eg. Photosynthetic plants, can derive all their cellular carbon, nitrogen and sulfur from the respective inorganic forms of these elements, i.e. they can obtain organic carbon from CO_2, organic nitrogen from nitrate, nitrite or ammonium. Other organisms eg. Fungi, have carbon auxotrophy, and nitrogen and sulfur autotrophy, i.e. they cannot synthesize organic carbon from CO_2, but they synthesize organic nitrogen. Nitrogen enters the organic form as ammonia and sulfur enter as sulfide. Since the most prevalent inorganic compounds of nitrogen in nature is nitrate and the plants depend on these for their nitrogen requirements, these substances must first undergo reduction

before they can be converted and incorporated into the structural and functional components of plant cells.

Our biosphere is an inexhaustible reservoir of nitrogen. However, most organisms that are both free living and associative symbolic, and certain free-living and associative or obligatory symbiotic bacteria, cannot make use of this free nitrogen. This handicap is attributed to their lack of the nitrogenase enzyme, which is essential for biological nitrogen fixation and has the ability to reduce molecular nitrogen to ammonia. Some blue-green algae and bacteria can fix nitrogen because they possess the nitrogenase enzyme.

2.2.2 Sulfur Metabolism

Like nitrogen and carbon, sulfur is known to undergo extensive metabolic transformation in the biosphere sulfate, the highly oxidized form of sulfur, is most readily available source of sulfur in nature, and procaryotes as well as eucaryotes derive all their sulfur from sulfate. Protozoa and animals, in general lack the enzyme systems found in cysteine and methionine, the key amino acids required for the formation of protein. Sulfate enters two major kinds of

biochemical reactions, viz. (1) esterification, and (2) reduction. In (1) sulfate esters of polysaccharides, phenols, steroids, and other organic substrates result. It is significant to note that whereas sulfate esterification is widespread among procaryotic and eucaryotic micro organisms and higher animals, it is very limited in higher plants. Carrageenin and agar are most common sulfated polysaccharides found in cell walls of diverse red algae.

In (2), sulfate is reduced to the thiol level. This reduction is the characteristic of all organisms excepts protozoa and most animals. The sulfate – reducing groups of organisms (algae, fungi, higher plants) and the sulfate – non-reducing groups (protozoa and animals) resemble each other in the oxidation of reduced sulfur compounds back to the level of sulfate.

2.2.3 Oxygen Metabolism and Toxicity

Living organisms metabolize three main gases present in the atmosphere, viz, CO_2, O_2, and N_2. The CO_2 and N_2 are fixed, i.e. incorporated into organic molecules, but O_2 is mainly utilized as a hydrogen acceptor, yielding water.

However, there exist several metabolic pathways by which O_2 is also incorporated into organic molecules, CO_2 and N_2 are fixed by only a few well-defined enzyme systems, e.g. ribulose biphosphate carboxylase, phosphoenolpyruvate carboxylase and nitrogenase. In contrast, O_2 incorporation can occur via widely different ways such as enzyme catalysis, chemical reactions (reduction), and physical (photodynamic) activation. There are three basic aspects of metabolism in which molecular oxygen is involved. During anabolic reactions, oxygen cannot be replaced by other compounds. However, there exist alternative anaerobic reaction sequences for most of the oxygen-dependent transformations. For the regeneration of the primary electron acceptors, such as NAD (Nicotinamide Adenine Dinucleotide) replaced by other oxidised inorganic or organic compounds.

Though oxygen is indispensable for all aerobic organisms, yet it has many toxic effects. When supplied at concentrations exceeding those in normal air, oxygen can damage plants and animals. Aerobic organisms must therefore passes some defensive devices against the toxic effects of oxygen.

Many of the damaging effects of oxygen are due to the formation of O_2 radicals; the toxicity is due more to the reactivities of chemical entities derived from dioxygen than to molecular oxygen per sec. Formation of the superoxide radical, in vivo plays a major role in the toxic effects of oxygen. A variety of systems generate the superoxide radical.

3. METABOLIC ACIDOSIS AND METABOLIC ALKALOSIS

3.1 METABOLISM ACIDOSIS

The term metabolic acidosis refers to all other types of acidosis besides those caused by excess CO_2 in the body fluids. Metabolic acidosis can result from several general causes.

1. Failure of the kidneys to excrete metabolic acids normally formed in the body.
2. Formation of excess quantities of metabolic acids in the body.
3. Addition of metabolic acids to the body by ingestion or infusion of acids.

4. Loss of base from the body fluids, which has the same effect as adding an acid to the body fluids.

Some specific conditions that cause metabolic acidosis are the following :

A. RENAL TUBULAR ACIDOSIS

This types of acidosis results from a defect in renal excretion of hydrogen ion or in re-absorption of bicarbonate, or both. These disorders are generally of two types :

a) Impairment of renal tubular bicarbonate reabsorption, causing the loss of bicarbonate in the urine, or

b) Inability of the renal tubular hydrogen secretory mechanism to establish a normal acidic urine, causing the excretion of an alkaline urine.

B. DIARRHOEA

Severe diarrhoea is probably the most frequent cause of metabolic acidosis. The cause of this acidosis is the loss of large amounts of sodium bicarbonate into the feces. This form

of metabolic acidosis is particularly serious and can be a cause of death, specially in young children.

C. VOMITING

Vomiting of gastric contents alone would cause loss of acid and a tendency towards alkalosis because the stomach secretions are highly acidic. However, vomiting of large amounts of the contents from deeper in the gastrointestinal tract, which sometimes occurs, causes loss of bicarbonate and results in metabolic acidosis in the some way that diarrhoea causes acidosis.

D. DIABETES MELLITUS

Diabetes mellitus is caused by lack of insulin secretion by the pancreas, which in turn prevents the normal use of glucose for metabolism. Instead, some of the fats are split into acetoacetic acid, and this is metabolized by the tissues for energy in place of glucose. With severe diabetes mellitus, blood acetoacetic acid levels can rise very high, thus causing severe metabolic acidosis.

E. INGESTION OF ACIDS

Rarely are large amounts of acids ingested in normal foods. However, severe metabolic acidosis occasionally can result from poisoning as a result of the ingestion of certain acidic poisons. Some of these include acetylsalicylies (aspirin) and methyl alcohol (which when metabolized forms formic acid).

F. CHRONIC RENAL FAILURE

When kidney function declines markedly, there is a buildup of the anions of weak acids in the body fluids that are not being excreted by the kidneys. In addition the decreased glomerular filtration rate reduces the excretion of phosphates and $NH4^+$, which reduces the amount of bicarbonate added back to the body fluids. Thus chronic renal failure can be associated with severe metabolic acidosis.

3.2 METABOLISM ALKALOSIS

When there is excess retention of bicarbonate or loss of hydrogen ion from the body, this results in metabolic

alkalosis. Metabolic alkalosis, is not nearly as common as metabolic acidosis, but some of the causes of metabolic alkalosis are as follows :-

A. ADMINISTRATION OF DIURETICS

All diuretics cause increased flow of fluid along the tubules, usually causing increased flow in the distal and collecting tubules. This in turn leads to increased reabsorption of sodium ions from these parts of the nephrons. These changes in turn lead to the development of alkalosis, characterized by increased extracellular fluid bicarbonate concentration.

B. EXCESS ALDOSTERONE

When large amounts of aldosterone are secreted by the adrenal glands, a mild metabolic alkalosis develops. This increased secretion of hydrogen ions leads to increased excretion of hydrogen ions by the kidneys and, therefore, metabolic alkalosis.

C. VOMITING OF GASTRIC CONTENTS

Vomiting of the gastric contents alone, without vomiting the lower gastrointestinal contents, causes loss of the HCI secreted by the stomach mucosa. The net result is a loss of and from the extra cellular fluid and development of metabolic alkalosis. This type of alkalosis occurs specially in neonates who have pyloric obstruction caused by hypertrophied pyloric sphincter muscles.

D. INGESTION OF ALKALINE DRUGS

One of the common causes of metabolic alkalosis is ingestion of alkaline drugs, such as sodium bicarbonate, for the treatment of gastritis or peptic ulcer.

4. METHOD OF STUDY OF METABOLISM

The following methods are generally used in the study of metabolism.

4.1 Analysis of blood and tissues

4.2 Analysis of excreta

4.3 Respiratory exchange.

4.4 Injecting endocrine preparations or removing the endocrine glands.

4.5 Perfusion of Viscera

4.6 Tissue slice technique.

4.7 Homogenate technique.

4.8 Enzyme studies.

4.9 Use of enzyme inhibitors.

4.10 In born errors of Metabolism.

4.11 Studies with microorganisms.

4.12 Use of radioactive and mass isotopes.

4.1 ANALYSIS OF BLOOD AND TISSUES

To find the changes undergone by a substance, a sample blood or of the tissue where the substance is being metabolised can be taken before and after the substance is administered and analysed. Any changes in the composition have to be cautiously interpreted in relation to the metabolism of the substance under study. Eg. When glucose is administered, the glycogen content of muscle and liver increases with a simultaneous fall of glucose levels in the initially raised blood glucose. This can be interpreted to mean that the liver and muscle have taken up the glucose from blood and converted it to glycogen.

4.2 ANALYSIS OF EXCRETA

Usually urine is analysed. The quantity of urinary nitrogen excreted in a day will enable the estimation of the amount of protein catabolized during that period. Each gram of urinary nitrogen indicates 6.25 grams of protein catabolized.

In a diabetic individual or in an experimental animal where glucose reabsorption by the renal tubule is prevented by poisoning with iodoacetate or phorrhizin, the feeding of different substance and the estimation of urinary glucose will give information as the how much of the substance is convertible to glucose in the body.

4.3 RESPIRATORY EXCHANGE

The ratio of the quantity of carbon dioxide eliminated to the oxygen utilized (CO_2, $1O_2$) in a given time is known as the respiratory quotient or R.Q. The R.Q. is I.O. of carbohydrates are solely being metabolized, 0.7 if fats are solely metabolized and 0.80 for proteins. The R.Q. will thus enable in having an

insight into the proportional of the three principal constituents metabolized.

4.4 INJECTING ENDOCRINE PREPARATIONS OR REMOVING THE ENDOCRINE GLANDS

The action of various hormones which influence metabolism can be studied by studying the effects of removal of each of the glands. All the effects produced by the removal will be relieved, if to such an animal, a purified preparation of the hormone is administered. E.g. alloxan which destroys B-cell of the pancreas, will produce almost similar changes as removal of pancreas.

4.5 PERFUSION OF VISCERA

The perfusion can be done in situ with the viscera still in the body or after isolation and removal from the body. The substance under study is perfused through the arterial supply to the viscera and the blood or perfuse from the vein is collected and analysed. The tissue itself can be analyzed at the end of the experiment. Perfusion of the liver with amino

acids may lead to their deamination and the perfusate will contain the corresponding a-keto acids.

4.6 TISSUE SLICE TECHNIQUE

This was perfected by Warburg. Extremely thin slices (almost unicellular in thickness) can be cut using suitable slicing techniques. Slices cut from a freshly collected liver tissues can be incubated in a suitable medium of saline and nutrients and after a given time the changes undergone by a particular nutrient. The respiratory exchanges (O_2 intake and CO_2 output) can also be studied in a suitable apparatus known as Baresoft-Warburg monometric apparatus. Studies on the metabolism of liver and brain are usually performed using such apparatus.

4.7 HOMOGENATE TECHNIQUE

Instead of intact viscera or tissue slices where the cellular organization is intact, the tissue may be broken up by grinding it with sand or in a homogenizer and the material suspended is saline or suitable medium known as the 'homogenate' can be used for study. The homogenate may

also be separated by ultra centrifugation into the various subcellular components such as nuclei, mitochondria, ribosomes and cytoplasmic supernatant and the location of the enzymes and their action can be studied in each of the fractions separately. Such studies have revealed the occurrence of the reactions of glycolysis in the cytoplasm, the reactions of citric acid cycle and oxidative phosphorylation in the mitochondria and protein synthetic reactions in the ribosomes.

4.8 ENZYME STUDIES

Since all the metabolic reactions are brought about ultimately by enzymes and since many enzymes are now available in a pure state, individual enzyme reactions can be studied to get the overall sequence of events.

4.9 USE OF ENZYME INHIBITORS

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Many of the reactions proceed as chain reactions and it is difficult to study the intermediate substances formed, e.g. glucose or glycogen is rapidly converted to pyruvic acid or lactic acid by action of a series of enzymes. If one of the

enzymes involved in the chain of reactions is inhibited by a poison the preceding reactions in the chain can be studied.

4.10 INBORN ERRORS OF METABOLISM

Nature occasionally provides similar opportunities in certain disease known as 'molecular disease' or 'inborn errors of metabolism'. One of the enzymes required in the metabolism is absent from birth giving rise to accumulation and excretion of the earlier intermediates formed and thus enabling a study of the metabolic process of that substance e.g. alkaptonuria and cystinuria in the study of metabolism of homogentisic acid and sulfur containing amino acids.

4.11 STUDIES WITH MICRO ORGANISM

Microoganism can be grown on purified media since they multiply at the rapid rate, the changes produced in the media and the metabolic processes can be studied in detail. It is also possible to produced mutant strains of the microorganism and study the effect of the lack or addition of an enzyme or a metabolite. Much of the recent advances in genetics, we owe to studies on the microorganism E.Coli.

4.12 USE OF RADIOACTIVE AND MASS ISOTOPES

In more recent times, the availability of isotopes and instruments for the detection of radioactive as well as mass isotopes have aided greatly in confirming some of the earlier findings arrived at the simpler methods and in making further advances in several hitherto unexplored fields as well. Substances can be prepared incorporating the isotope instead of the natural element, such substances are said to be 'tagged' or 'labeled' e.g., glucose can be prepared containing C_{14} in one or more of its carbons instead of the normal C_{12}. The tagged substances can be administered to the intact animal and the changes undergone by the substance can be tracked by analyzing the substances which contain the 'label'.

By using such methods it was found that in glycolysis the third and the fourth carbons of glucose are oxidized first, whereas in hexose mono phosphate pathway, the first carbon is oxidized earliest.

CONCLUSION

The above description shows that metabolism is an important activity which takes place in all living beings. The various biochemical reactions which are found in all living organism are synthesis the tissue components and also broken down them into simple substance. Thus, metabolic activities repaired damage tissues and also liberate energy.

An attempt has been made to identify some of the characteristic of metabolism. However, a number of diseases caused by metabolic acidosis and alkalosis are also discussed.

During the recent time a number of techniques had developed to study the metabolism i.e. tissue slice technique, homogenate techniques, use of radioactive and mass isotopes. Much of the recent advances in genetics, we owe to studies on the microorganism E.Coli.

An analysis shows that the literature on metabolism appeared over a long period and still it is of much important to the researchers for their research work.

Chapter - 3

Bibliometrics: Objective and Methodology

OBJECTIVE AND METHODOLOGY

The exponential growth of the production of all types of literature during the last few decades has caused librarians and bibliographers to look for quantitative and statistical methods to keep track of the flood of information.

Bibliometrics have been extended today to cover not only the behaviour and properties or characteristics of documents but also of users in the library, use patterns, user's needs, and so on.

1. OBJECTIVE OF THE STUDY

This study aims at identifying some of the characteristics of Metabolism literature, used by the researcher over a long period with a view to known the place, time, subject and country of origin, from where the documents are being published. The present study will help the librarian in preparing the subscription list.

More precisely the objective of the studies are as follows :-

a. ***Form of Documents*** : To find out the most used form of source material i.e. periodical articles, research reports, conference proceedings, bulletin etc.

b. ***Geographical Studies*** : To know the most dominant country/countries producing the literature on the subject.

c. ***Language wise distribution of items*** : To know the dominating languages in which most of the literature on the subject has been produced.

d. ***Ranking of periodicals*** : To know the core periodicals containing most of the literature on Metabolism.

e. ***Ranking of Authors*** : To know the the eminent personalities in the field of metabolism.

f. ***Subject Dispersions*** : To show the interdisciplinary character of the subject under study.

g. ***Year wise distribution of items*** : To known the most productive year / years of the literature on the subject.

h. ***Application of Bibliometric Law's*** : Bibliometric laws are applied on collected data to focus on the recent trends in Metabolism.

2. METHODOLOGY OF THE STUDY

L. Egghel proposed the methodology of Bibliometrics through the following diagrams.

RAW DATA

|

STRUCTURE

|

ANALYSIS INTERPRETATION OF DATA

|

CONCLUSIONS

L. Egghel – Methodological Aspect of Bibliography, Library Science and slant to Documentation and Information studies, 25.3 ; 1988.

2.1 SOURCE OF DATA

Biological Abstract is found to be most authentic and comprehensive source of literature in the field of Applied Biology. The information given there is the best and most used source of information. For the purpose of this study primary source could be taken into consideration, but because of the long list of source journals on the subject the method of counting becomes impracticable. Because of this and other reasons like geographical and linguistic bias, it was thought better to collect data from a secondary source like Biological Abstracts. Two latest available volumes of biological abstract (i.e. 1998-99) were chosen as the source document.

2.2 PREPARATION OF ENTRIES

By the help of Biological Abstract data was collected on catalogue cards (5x3). Each reference consisted information about author, year, language, form of document and place of origin.

2.3 ANALYSIS

4953 references collected from the two volume of biological abstracts and re-arranged in order to conduct the following studies.

2.3.1. Ranking of Periodicals

2.3.2. Geographical Scattering of Items

2.3.3. Year wise distribution of items

2.3.4. Language wise distribution of item

2.3.5. Subject dispersion.

2.3.6. Form wise distribution

2.3.7. Ranking of Authors

2.3.8. Application of Bibliometric Laws

2.3.1. Ranking of Periodicals

The main objective of this study is to find out the core periodicals containing the research literature on Metabolism. To conduct this study, the items published in different periodicals are grouped together and counted. Information about the most productive periodicals on the subject is much useful for the librarians as well as for research scholars. After the identification of core periodicals in the field, ranking of periodicals is done and tabulated.

2.3.2. Geographical Scattering of Items

This is done to determine the geographical scattering of items. The information was collected from the biological abstracts (1998-99) which clearly gives the place of origin of each item. The entries were then grouped on the basis of their country of origin. They were then counted and ranked in a table.

2.3.3. Yearwise Distribution of Items

This study is useful in knowing the currency of information in the secondary source and also in knowing the most productive year of the items ranked. Through this study, year wise publication of article is knows. The information about the period of origin of the item can be easily known by the bibliographic information of each item indexed in Biological Abstracts (1988-99).

2.3.4. Languagewise Distribution

As the coverage of Biological Abstracts is international. It lists research items published in different languages. It is, therefore, important to know the most dominant language used in scientific communication on the subject. It is made possible through bibliometric study.

2.3.5. Subject Dispersion

Most of the literature on a given subject is published in core journals. Some time some material of research value is published in the journals belonging to

related fields. It is, therefore, important to know the interdisciplinary nature of subject. This analysis is done on the basis of subject field of periodicals, the information about it was obtained from Ulrich International Periodical Directory (35th ed.). The analysis not only identified the core subject but also the related subjects publishing some relevant information on the subject under study.

2.3.6. Formwise distribution

Documents on any subject are published in different forms like periodical articles, research reports, letters, bulletins, conference proceedings, patents. It is interesting to know the most popular form of document. For this purpose the information about the form of document was collected and tabulated.

2.3.7. Ranking of Authors

This is done to know the eminent personalities in the subject. The data cards of different contributors in the field are separated out. The number of cards under

each name are counted and tabulated. Authors are then ranked in the order of decreasing productivity.

2.3.8. Application of Bibliometric Laws

The whole study is based on bibliometric laws such as Lotka, Bradford and Zipf's Law. For checking the validity of these laws, they will be individually applied on the analysed data and results are examined.

Chapter - 4

Data Analysis, Interpretation and Representation

DATA ANALYSIS, INTERPRETATION AND REPRESENTATION

For collecting the data, two volumes of Biological Abstracts for the years 1998-99 were consulted and a total number of 4953 references were collected. The 1998 volume of Biological abstracts contained 2559 references and that of 1999 contained 2394 references on the subject 'Metabolism'. Each entry consisted of information regarding author, title, journal, place, year, language and forms. The data collected on 5x3" catalogue cards was analysed under the following headings.

1. COUNTRYWISE DISTRIBUTION

Certain countries are leaders in research in various subjects. The articles on the subject metabolism are published in different journals and from different countries. The distribution of articles, published from different countries are revealed by organising the data in a systematic order. Table 1 shows the countrywise distribution of articles. This distribution shows the

countries producing most of the literature on Metabolism. By this type of bibliometric study information managers are helped in deciding about the procurement of documents from the most productive countries. This information is useful for the researchers also.

In the present study, some 54 countries, producing research material on Metabolism, are listed. The frequency of occurrence of research articles is the basis of ranking the countries. Analysis revealed that 43.60% of articles were published from U.S.A. only, followed by UK and Japan, which produced 9.81% and 7.79% articles respectively. The contribution of India on the subject is 1.07% which is lesser than Russia 1.65% and Spain 1.63%.

Table - 1

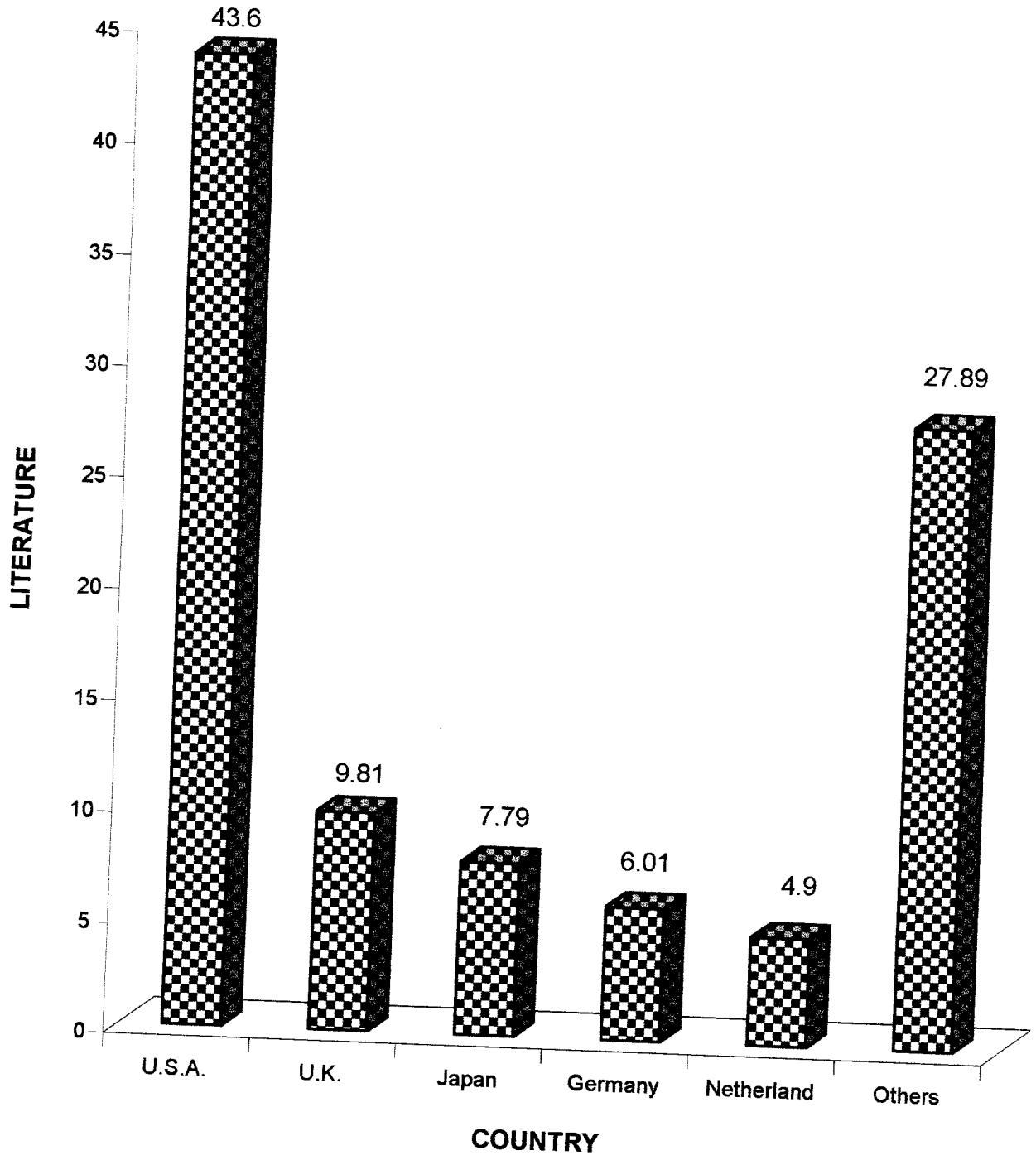
Coutnrywise Distribution :

Sl.No.	*Name of the Countries*	Frequency	Percentage
1	U.S.A.	2160	43.60
2	U.K.	486	9.81
3	Japan	386	7.79
4	Germany	298	6.01
5	Netherlands	243	4.90
6	France	160	3.23
7	Canada	142	2.86
8	Italy	137	2.76
9	China	116	2.34
10	Russia	82	1.65
11	Spain	81	1.63
12	India	53	1.07
13	Finland	51	1.02
14	Paris	43	0.86
15	Austria	41	0.82
16	Australia	34	0.68
17	Brazil	33	0.66
18	Sweden	30	0.60
19	Hong Kong	29	0.58

Sl.No.	*Name of the Countries*	Frequency	Percentage
20	Ukraine	28	0.56
21	Switzerland	27	0.54
22	Belgium	22	0.44
23	Poland	20	0.40
24	Argentina	18	0.36
25	Egypt	16	0.32
26	Hungry	16	0.32
27	Israel	16	0.32
28	Saudi Arabia	15	0.30
29	London	15	0.30
30	Moscow	14	0.28
31	South Africa	14	0.28
32	Thailand	12	0.24
33	Taiwan	11	0.22
34	Norway	10	0.20
35	Denmark	9	0.18
36	Romania	9	0.18
37	South Korea	9	0.18
38	Venezuela	8	0.16
39	Turkey	8	0.16
40	Singapore	7	0.14
41	Mexico	6	0.12

Sl.No.	*Name of the Countries*	Frequency	Percentage
42	New Zealand	6	0.12
43	Crotia	4	0.08
44	Czech Republic	4	0.08
45	Libiya	4	0.08
46	Portugal	4	0.08
47	Slovakia	4	0.08
48	Jordan	3	0.06
49	Bulgaria	2	0.04
50	Kuwait	2	0.04
51	Pakistan	2	0.04
52	Belarus	1	0.02
53	Sri Lanka	1	0.02
54	Tunisia	1	0.02
	TOTAL	**4953**	**99.83**

COUNTRYWISE DISTRIBUTION



2. YEARWISE DISTRIBUTION

This study is useful in knowing the currency of information in the secondary sources. It may also be useful to know the most productive year of the literature on Metabolism. Through this study we know that how many articles were published in which year. The information about the period of origin of item can be easily found out by its bibliographical information. As mentioned earlier, two volumes of Biological Abstracts (1998-99) were taken for the collection of data. The analysis shows that the publications in two volumes of Biological Abstract varied from 1995 to 1999. Most of the articles on the subject metabolism, occurred in 1998. Table 2 reveals that as many as 1877 articles were published in 1998. Similarly, some 1609 articles were reported in the volume of 1999.

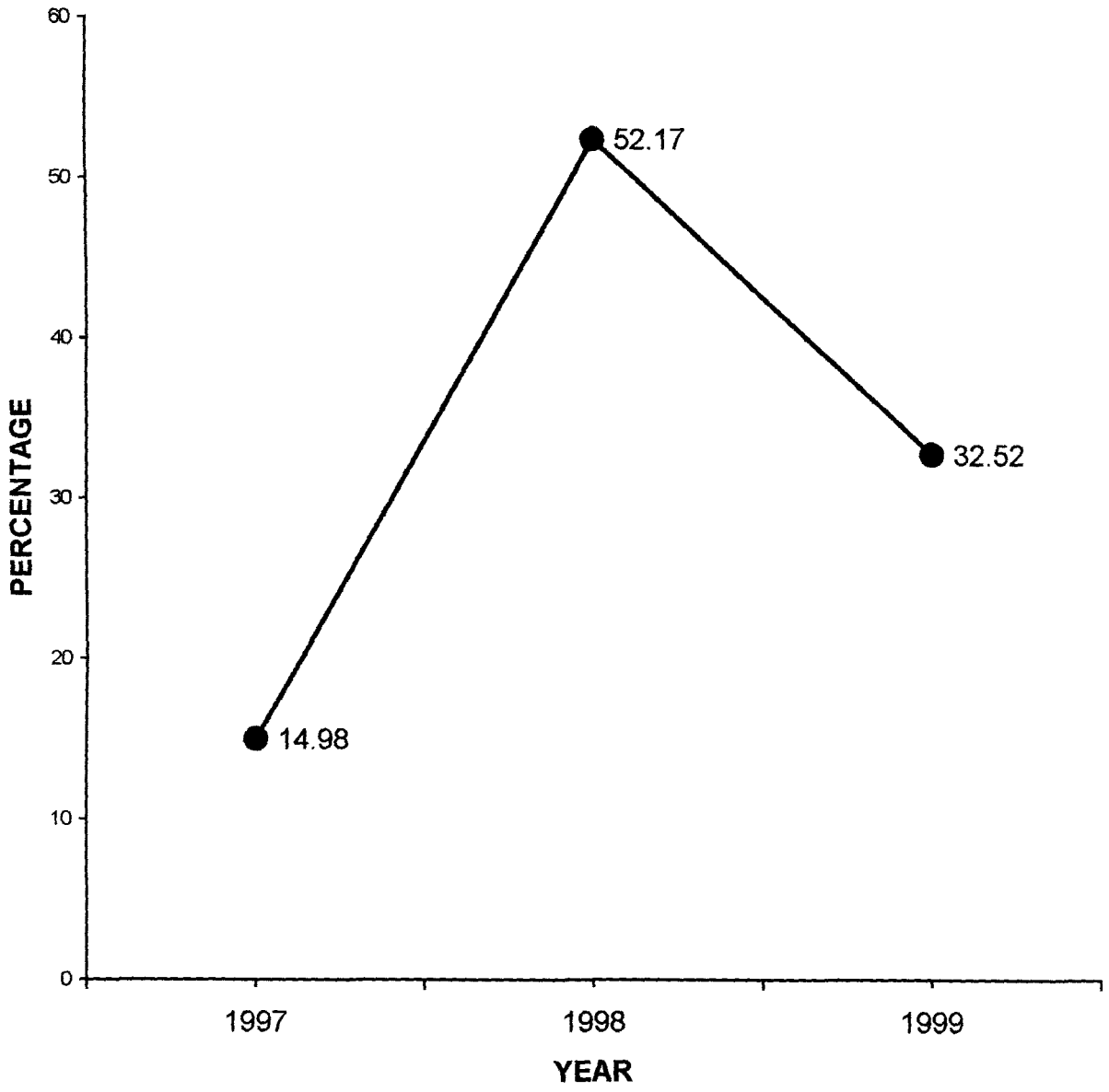
Table 2 shows the chronological scattering of all references collected from Biological Abstract. The analysis shows that 52.17% Literature on the subject were produced in 1998, 32.52% Literature on Metabolism was published in 1999. While 1997 reported the publication of only 14.98% of Literature on the subject.

Table - 2

Yearwise Distribution of Items :

Sl.No.	Period of Origin	Frequency of Occurrence		Total Frequency of Occurrence	Percentage Frequency of Occurrence	Cumulative Percentage Frequency
		Vol. Of 1998	Vol. Of 1999			
01	1995	07	00	07	0.14	0.14
02	1996	06	03	09	0.18	0.32
03	1997	667	75	742	14.98	15.3
04	1998	1877	707	2584	52.17	67.47
05	1999	02	1609	1611	32.52	99.99
TOTAL		**2559**	**2394**	**4953**	**99.99**	

CHRONOLOGICAL DISTRIBUTION



3. RANKING OF PERIODICALS

Periodicals are the sources of current information. The researchers and the scientists require current information to keep themselves abreast of what is going on in their own fields of study. Periodicals thus play a vital role in scientific communication. However, the studies conducted by Bradford have demonstrated that in every subject there are certain core journals which have contributed most of the literature. This information is useful for the librarian and the users alike. A librarian will be greatly helped by knowing what are the core journals in a given subject. Thereby, preparing the subscription list of periodicals for his library in such a way that the limited resources of the library are spent to maximise the user's satisfaction. The researchers / scientist in a given field of study are also helped by the information regarding core journals in their field so that they do not miss any thing of research value published in these journals.

This study is therefore, aimed at identifying the core periodicals in Metabolism.

From the collected data, it was found that 845 periodicals carry the whole literature. Table 3 shows first 202 most cited periodicals with a minimum of 5 frequency of occurrence of items, covering almost 3501 of the periodical references. The remaining 643 journals 12.98% were excluded. The first 14 titles exclusively focussed on the subject Metabolism contributed to 25.95% periodicals references.

For measuring its utility the frequency of occurrence of a periodical is a right way. In a total of 845 periodicals, the selective 202 periodicals occupied 44th rank positions. This list of core periodicals may be of use for information managers, research scholars and documentalist's interest.

The periodical which occupied first rank is ***Metabolism Clinical and Experimental*** covering 4.60% of total items. ***Journal of Inherited Metabolic Disease*** occupied second position of which frequency is

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144 i.e. 2.84% of literature covered. ***American Journal of Physiology***, occupied third rank with a frequency of 136 covering 2.74% of Literature on the subject. The Journal, ***Applied and Environmental Microbiology*** ranked fourth with a frequency of 99 covering 1.99% of literature.

Table - 3

Ranking of Periodicals

S.No.	*Rank*	*Name of Periodicals*	*Country*	*Frequency*	*Percentage*
1	1	Metabolism Clinical and Experimental	U.S.A.	228	4.60
2	2	Journal of Inherted Metabolic Disease	U.S.A.	144	2.84
3	3	American Journal of Physiology	U.S.A.	136	2.74
4	4	Applied and Environmental Microbiology	Japan	99	1.99
5	5	Journals of Nutrition	U.S.A.	97	1.95
6	6	Phytochemistry (Oxford)	U.S.A.	96	1.93
7	7	International Journal of Obesity	U.S.A.	90	1.81
8	8	Journal of Lipid Research	U.S.A.	67	1.35
9	9	Plant Physiology (Rock Ville)	U.S.A.	61	1.23
10	10	Comparative Biochemistry and Physiology	U.S.A.	60	1.21
11	11	FEBS Letters	Netherlands	57	1.15

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
12	12	Journal of Bacteriology	U.S.A.	54	1.09
13	13	FEMS Microbiology Letters	Netherlands	52	1.04
14	14	Diabetes	Finland	51	1.02
15	15	Journal of Plant Physiology	U.S.A.	44	0.88
16	16	Journal of Applied Physiology	U.S.A.	41	0.82
17	17	Journal of Biological Chemistry	U.S.A.	40	0.80
18	18	Biochemica et Biophysica Acta	U.S.A.	37	0.74
19	19	Diabetologia	Germany	36	0.72
20	19	Journal of Clinical Investigation	Italy	36	0.72
21	20	American Journal of Clinical Nutrition	U.S.A.	35	0.70
22	21	Atheroscierosis	U.S.A.	34	0.68
23	21	Physiologia Plantarum	Canada	34	0.68
24	22	Microbiologiya	Japan	33	0.66

S.No.	*Rank*	*Name of Periodicals*	*Country*	*Frequency*	*Percentage*
25	23	Journal of Experimental Biology	Germany	30	0.60
26	24	Biological Trace Element Research	U.S.A.	27	0.54
27	24	European Journal of Clinical Investigation	U.K.	27	0.54
28	25	European Journal of Peadiatrics	Germany	25	0.50
29	25	Journal of Experimental Botany	U.K.	25	0.50
30	25	Lancet (North American Edition)	U.S.A.	25	0.50
31	25	Life Science	U.S.A.	25	0.50
32	26	Biochemical and Biophysical Research Communication	U.S.A.	24	0.48
33	26	Biochemical Journal	France	24	0.48
34	26	European Journal of Biochemistry	U.K.	24	0.48
35	26	Microbiology (Reading)	U.K.	24	0.48
36	26	Proceeding of the National Academy of Sciences of the United State of America	U.S.A.	24	0.48

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
37	26	Prostaglandins Leukotrienes and Essential Fatty Acids	U.K.	24	0.48
38	27	Diabetes and Metabolism	France	23	0.46
39	27	Free Radical Biology & Medicine	U.S.	23	0.46
40	28	Archives of Microbiology	Germany	22	0.44
41	28	Journal of Agriculture and Food Chemistry	U.S.A.	22	0.44
42	29	Xenobiotica	U.K.	21	0.42
43	30	Journal of Experimental Medicine	U.K.	20	0.40
44	30	Mineral and Electrolyte Metabolism	U.S.A.	20	0.40
45	30	Planta (Berlin)	Germany	20	0.40
46	30	Plant Science (Shannon)	U.S.A.	20	0.40
47	30	Soil Biology and Biochemistry	U.K.	20	0.40
48	31	Clinical Science (London)	U.K.	19	0.38

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
49	31	Journal of Japan Diabetes Society	Japan	19	0.38
50	31	Medicine & Science in Sport and Exercise	U.S.A.	19	0.38
51	32	Acta Diabetologia	Germany	17	0.34
52	32	Canadian Journal of Microbiology	Canada	17	0.34
53	32	Drug Metabolism and Disposition	U.S.A.	17	0.34
54	32	Hormone and Metabolic Research	Germany	17	0.34
55	32	Lipids	U.S.A.	17	0.34
56	32	Molecular and Cellular Biochemistry	U.S.A.	17	0.34
57	32	Plant Journal	U.K.	17	0.34
58	33	Biochemistry	Netherlands	16	0.32
59	33	Pediatric Research	U.S.A.	16	0.32
60	34	Arterioscierosis Thrombosis and Vascular Biology	Sweden	15	0.30
61	34	Tetrahedran Letters	France	15	0.30

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
62	35	Biochemistry and Molecular Biology International	U.K.	14	0.28
63	35	British Journal of Nutrition	U.K.	14	0.28
64	35	European Journal of Clinical Nutrition	U.K.	14	0.28
65	36	Archives of Biochemistry and Biophysics	U.K.	13	0.26
66	36	Biofactors	Netherlands	13	0.26
67	36	Clinica Chimica Acta	France	13	0.26
68	36	European Journal of Applied Physiology & Occupational Physiology	U.K.	13	0.26
69	36	Journal of Animal Physiology and Animal Nutrition	Germany	13	0.26
70	36	Journal of Pediatrics	U.S.A.	13	0.26
71	36	Plant Physiology & Biochemistry (Paris)	Paris	13	0.26
72	37	Biologia Plantarum	Japan	12	0.24
73	37	Biotechnology and Bioengineering	U.S.A.	12	0.24

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
74	37	Indian Journal of Experimental Biology	India	12	0.24
75	37	Journal of Experimental Zoology	U.S.A.	12	0.24
76	37	Journal of Nutritional Biochemistry	U.K.	12	0.24
77	37	Journal of Physiology	U.S.A.	12	0.24
78	37	Journal of Virology	U.S.A.	12	0.24
79	37	Nutrition Research	U.S.A.	12	0.24
80	37	Respiration Physiology	U.K.	12	0.24
81	38	Australian Journal of Plant Physiology	Australia	11	0.22
82	38	Biochemical Pharmacology	U.S.A.	11	0.22
83	38	Diabetes Research and Clinical Practice	Japan	11	0.22
84	38	JAMA (Journal of American Medical Association)	U.S.A.	11	0.22
85	38	Journal of Bio-sciences	Japan	11	0.22

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
86	38	Mededelingen Facutteit Landbouwkundige en-toegeposte Biologische Wetenschappen Universitiet Gent	Belgium	11	0.22
87	39	Alcohol Clinical and Experimental Research	U.S.A.	10	0.20
88	39	Annals of Internal Medicine	Canada	10	0.20
89	39	Applied Microbiology and Biochemistry	Japan	10	0.20
90	39	Bioscience Biotechnology & Biochemistry	Japan	10	0.20
91	39	European Journal of Endocrinology	U.K.	10	0.20
92	39	Journal of Neurochemistry	U.S.A.	10	0.20
93	39	Journal of Theoritical Biology	Germany	10	0.20
94	39	Molecular Genetics and Metabolism	U.S.A.	10	0.20
95	39	Physiology & Behaviour	U.S.A.	10	0.20
96	39	Planta (Heidelberg)	Germany	10	0.20
97	40	Annales de Biologie Clinique	France	9	0.18

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
98	40	Annales of Clinical Biochemistry	France	9	0.18
99	40	Archives of disease in childhood	U.S.A.	9	0.18
100	40	Archives of Internal Medicine	Israel	9	0.18
101	40	Current Science	India	9	0.18
102	40	Journal of Dairy Sciences	U.S.A.	9	0.18
103	40	Journal of Parenteral and Enternal Nutrition	U.S.A.	9	0.18
104	40	Mycological Research	U.K.	9	0.18
105	40	New Phytologist	U.K.	9	0.18
106	40	Plant and Cell Physiology	Japan	9	0.18
107	40	Plant Growth Regulation	Netherlands	9	0.18
108	41	Clinical Chmistry	Italy	8	0.16
109	41	Clinical Nephrology	U.K.	8	0.16
110	41	Clinical Nutrition (Edinburgh)	U.K.	8	0.16

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
111	41	Doklady Akademi Nauk	Russia	8	0.16
112	41	Journal of Applied Microbiology	U.S.A.	8	0.16
113	41	Journal of Clinical Endocrinology and Metabolism	U.S.A.	8	0.16
114	41	Journal of Comparative Physiology B Biochemical Systematic and Environmental Physiology	U.K.	8	0.16
115	41	Journal of Nutritional Science and Vitaminology	Germany	8	0.16
116	41	Journal of Phycology	U.S.	8	0.16
117	41	Journal of Rheumatology	U.S.A.	8	0.16
118	41	Kidney International Supplement	U.S.	8	0.16
119	41	Molecular Microbiology	U.S.A.	8	0.16
120	41	Ukrainskii Biokhimicheskii Zhurnal	Ukraine	8	0.16
121	42	Antonie Van Leeuwenhock	Russia	8	0.16

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
122	42	Canadian Journal of Zoology	Canada	7	0.14
123	42	Clinical Diabetes	U.S.A.	7	0.14
124	42	Current Microbiology	U.S.A.	7	0.14
125	42	Journal of Hepatology	Switzerland	7	0.14
126	42	Journal of Thermal Biology	U.S.A.	7	0.14
127	42	Neurochemical Research	U.S.A.	7	0.14
128	42	New England Journal of Medicine	U.K.	7	0.14
129	42	Vaprosy Meditsinskoi Khimii	Russia	7	0.14
130	43	Acta Physiologiae Plantarum	Canada	6	0.12
131	43	American Journal of Medicine	U.S.A.	6	0.12
132	43	Amino Acid (Vienna)	Austria	6	0.12
133	43	Annals of Saudi Medicine	Saudi Arabia	6	0.12
134	43	Archieves de Pediatrie	U.S.A.	6	0.12

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
135	43	Biotechnology Letters	U.S.A.	6	0.12
136	43	Brain Research	Netherlands	6	0.12
137	43	Brazillian Journal of Medical and Biological Research	Brazil	6	0.12
138	43	Canadian Journal of Animal Science	Canada	6	0.12
139	43	Canadian Journal of Fisheries and Aquatic Science	Canada	6	0.12
140	43	Chemico-Biological Interactions	Germany	6	0.12
141	43	European Journal of Phycology	U.K.	6	0.12
142	43	Fiziologiya Cheloveka	Russia	6	0.12
143	43	Journal of Bioenergetics and Biomembrane	U.S.A.	6	0.12
144	43	Journal of Nutritional Biochemistry	U.S.A.	6	0.12
145	43	Journal of Pediatrics Endocrinology & Metabolism	Japan	6	0.12

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
146	43	Journal of Pharmacology and Experimental Theraputus	U.S.A.	6	0.12
147	43	Journal of Photochemistry & Photobiology B Biology	Japan	6	0.12
148	43	JPGN	U.S.A.	6	0.12
149	43	Likars'ka Sprova	Ukraine	6	0.12
150	43	Pharmacology Toxicology and Endocrinology	Japan	6	0.12
151	43	Physiological Zoology	Russia	6	0.12
152	43	Post Graduate Medical Journal	Canada	6	0.12
153	43	Prikladnaya Biokhimiya i Mikrobiologiya	Russia	6	0.12
154	43	Ravista Brasilaria de Fisiologia Vegetal	Brazil	6	0.12
155	43	Ravista Brasilaria de Botanica	Brazil	6	0.12
156	43	Saudi Medical Journal	Saudi Arabia	6	0.12
157	44	Acta Paediatric Japanica	Japan	5	0.10

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
158	44	Acta Paediatrica	U.S.A.	5	0.10
159	44	Acta Phytophysiological Sinica	Japan	5	0.10
160	44	Acta Phytophysiologica et therapeutica	Argentina	5	0.10
161	44	Acta Societalic Bolanicorum Poloniae	Poland	5	0.10
162	44	Alcohol & Alcoholism	U.S.A.	5	0.10
163	44	American Journal of Emergency Medicine	U.S.A.	5	0.10
164	44	Anaerobe	U.S.A.	5	0.10
165	44	Annals of Nutrition & Metabolism	U.K.	5	0.10
166	44	Australian Journal of Zoology	Austria	5	0.10
167	44	Biochemical Society Transcription	Japan	5	0.10
168	44	Blood	U.S.A.	5	0.10
169	44	Burns	U.S.A.	5	0.10
170	44	Canadian Journal of Botany	Canada	5	0.10

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
171	44	Canadian Journal of Physiology & Pharmacology	Canada	5	0.10
172	44	Chemistry and Physics of Lipids	U.S.A.	5	0.10
173	44	EMBO (European Molecular Biology Organization) Journal	U.K.	5	0.10
174	44	European Journal of Pharmacology	U.K.	5	0.10
175	44	Fiziologiya Rastenii (Moscow)	Moscow	5	0.10
176	44	Heart	London	5	0.10
177	44	Insect Biochemistry & Molecular Biology	U.K.	5	0.10
178	44	International Journal of Sports Medicine	Germany	5	0.10
179	44	International Journal of Vitamin and Nutrition Research	U.S.	5	0.10
180	44	IOVS	U.S.A.	5	0.10
181	44	Journal of Animal Science	U.S.A.	5	0.10
182	44	Journal of Biochemistry	Japan	5	0.10

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
183	44	Journal of Diabetes and Its complications	U.K.	5	0.10
184	44	Journal of Fermentation and Bioengineering	Germany	5	0.10
185	44	Journal of Hypertension	Switzerland	5	0.10
186	44	Journal of Laboratory and Clinical Medicine	U.S.A.	5	0.10
187	44	Journal of Mamology	U.S.A.	5	0.10
188	44	Journal of Physiology and Biochemistry	Spain	5	0.10
189	44	Magnesium Research	U.S.A.	5	0.10
190	44	Nippon Nogeikagaku Kaishi	Japan	5	0.10
191	44	Pancreas	U.S.A.	5	0.10
192	44	Physiological Research	U.S.A.	5	0.10
193	44	Plant Cell	Japan	5	0.10
194	44	Plant Cell Report	U.S.A.	5	0.10

S.No.	Rank	Name of Periodicals	Country	Frequency	Percentage
195	44	Q.J.M.	U.K.	5	0.10
196	44	Schweizerische Medizinische Wochenschrift	Russia	5	0.10
197	44	Science (Washington D.C.)	U.S.A.	5	0.10
198	44	Small Ruminant Research	U.S.A.	5	0.10
199	44	Terapeuticheskii Arkhiv	Russia	5	0.10
200	44	Trace Element and Electrolytes	U.S.A.	5	0.10
201	44	Veterinary Clinic of North America Small Animal Practice	U.S.A.	5	0.10
202	44	Weischengwu xuebaoc	Russia	5	0.10

Table 3 shows the range of frequency of occurrence of items that 3 periodicals have their frequency of range more than 100 times and total number of items are 505 (10.19%). The periodicals having their occurrence frequency in range of 66 – 99 is 7 and the number of items listed are 570 (11.50%). In the third frequency range are 30 – 59 number of periodicals are 15, listing 614 items (12.39%). In fourth frequency range of 20 to 29, the number of periodicals is 72 and the number of items are 509 (10.27%). In fifth frequency range of 10 to 19 are 49 periodicals and the number of items are 645 (13.02%). Similarly, in the sixth frequency range of 5 – 9 is 106 periodicals and the number of items are 658 (13.28%). In the last frequency range of 1 – 4, the number of periodicals are 643 listing 1452 items (29.31%).

Table

Showing Range of Frequency

Sl.No.	Frequency of Range	No. of Periodicals	No. of items	Percentage (%)	Cumulative Percentage
01	100 – 230	3	505	10.19	10.19
02	60 – 99	7	570	11.50	21.69
03	30 – 59	15	614	12.39	34.05
04	20 – 29	22	509	10.27	44.35
05	10 – 19	49	645	13.02	57.37
06	5 – 9	106	658	13.28	70.65
07	1 – 4	643	1452	29.31	99.96
	TOTAL	**845**	**4953**	**99.96**	

4. LANGUAGEWISE DISTRIBUTION

Language is the prime medium of communication in the exchange of scientific information amongst scientists. It is, therefore, important to know the most dominant language or languages in which the literature on Metabolism is being produced in the world. This type of study will be useful for both the user and the information scientists. The special libraries dealing with the subject Metabolism may gear up to provide translation services in the dominant languages. It may also help the librarian to prepare subscription list.

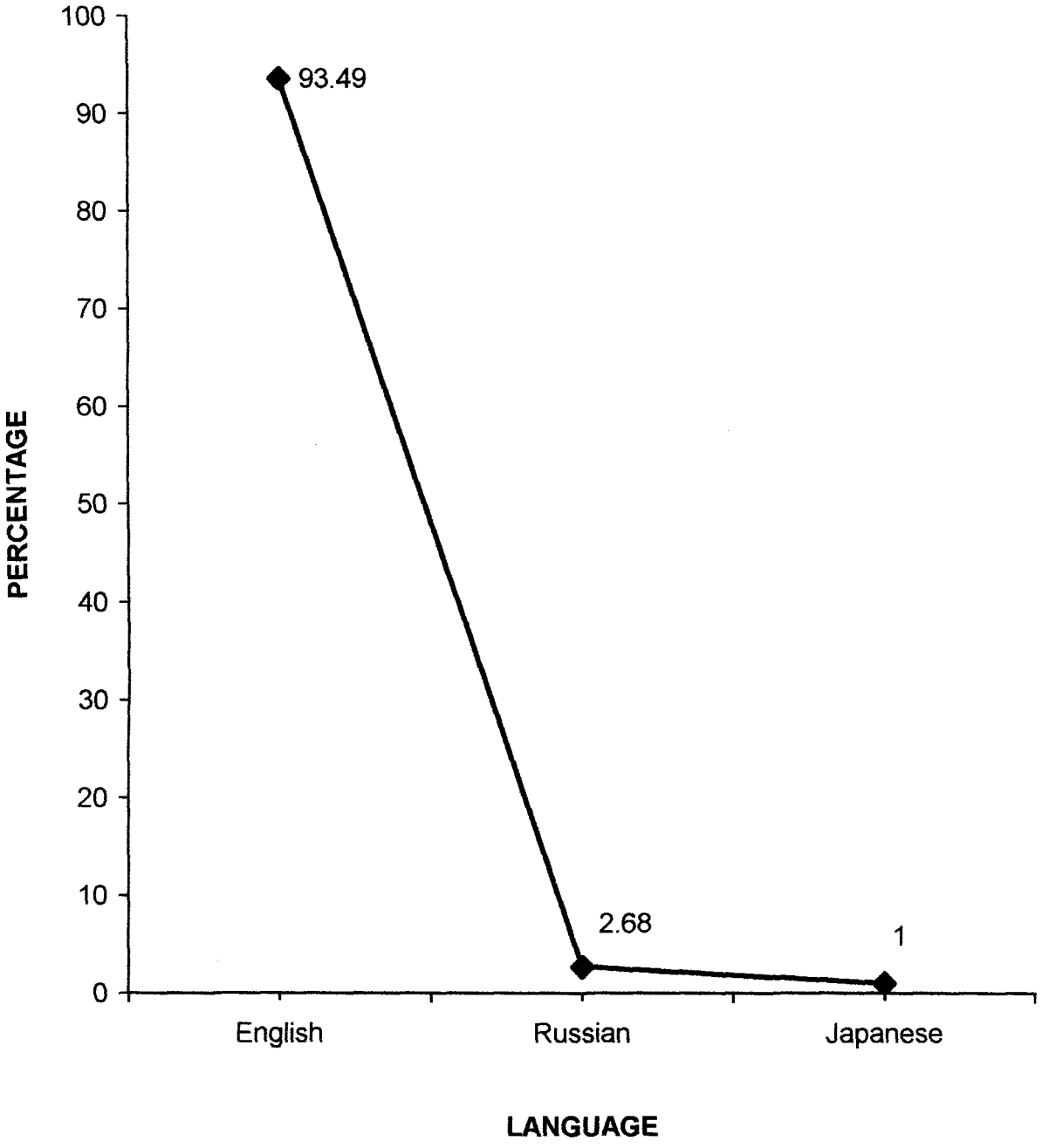
Table 4 shows that total number of 4953 items were published in 19 different languages. English was found to be the most dominant language as it covers 4631 items constituting 93.49% of literature on the subject. The second position is occupied by Russian literature covering 2.68% of the total items. Third and fourth positions were occupied by Japanese (1%) and French (0.78%) languages.

Table - 4

Languagewise Distribution of Items

S.No.	Rank	Name of Language	Frequency Occurrence	Frequency Percentage	Cumulative Frequency Percentage
1	1	English	4631	93.49	93.49
2	2	Russian	133	2.68	96.17
3	3	Japanese	50	1.00	97.17
4	4	French	39	0.78	97.95
5	5	Chinese	29	0.58	98.53
6	6	German	20	0.40	98.93
7	7	Ukrainian	09	0.18	99.11
8	8	Spanish	07	0.14	99.25
9	9	Italian	06	0.12	99.37
10	9	Korean	06	0.12	99.49
11	10	Polish	05	0.10	99.59
12	10	Portugese	05	0.10	99.69
13	11	Serbo	03	0.06	99.75
14	11	Aungarian	03	0.06	99.81
15	12	Norwegian	02	0.04	99.85
16	12	Turkish	02	0.04	99.89
17	13	Bulgarian	01	0.02	99.91
18	13	Hebrew	01	0.02	99.93
19	13	Arabic	01	0.02	**99.95**
		TOTAL	**4953**	**99.95**	

LANGUAGEWISE DISTRIBUTION



5. FORMWISE DISTRIBUTION

The literature on a given subject is published in many different forms like articles, research reports, letters, bulletins, patents etc. It is interesting to know the most popular form of document. For this purpose an analysis has been done to find out the most popular form in which the latest information on the subject Metabolism is published. The information scientists and users become aware of the most dominant form of document on a particular subject. This type of analysis is helpful for the librarian also in the procurement of documents so that the requirements of researchers on the subjects are satisfied.

Formwise distribution of items is listed in Table 5. The analysis has been done on the basis of information found from two volumes of Biological Abstracts (1998-99). Out of a total of 4953 items periodical articles (4323 items), constitute (87.28%). This is followed by other forms like Research Reports (10.68%), Letters (0.84%),

Conference proceedings (0.68%), Reviews (0.38%) and Bulletins (0.12%).

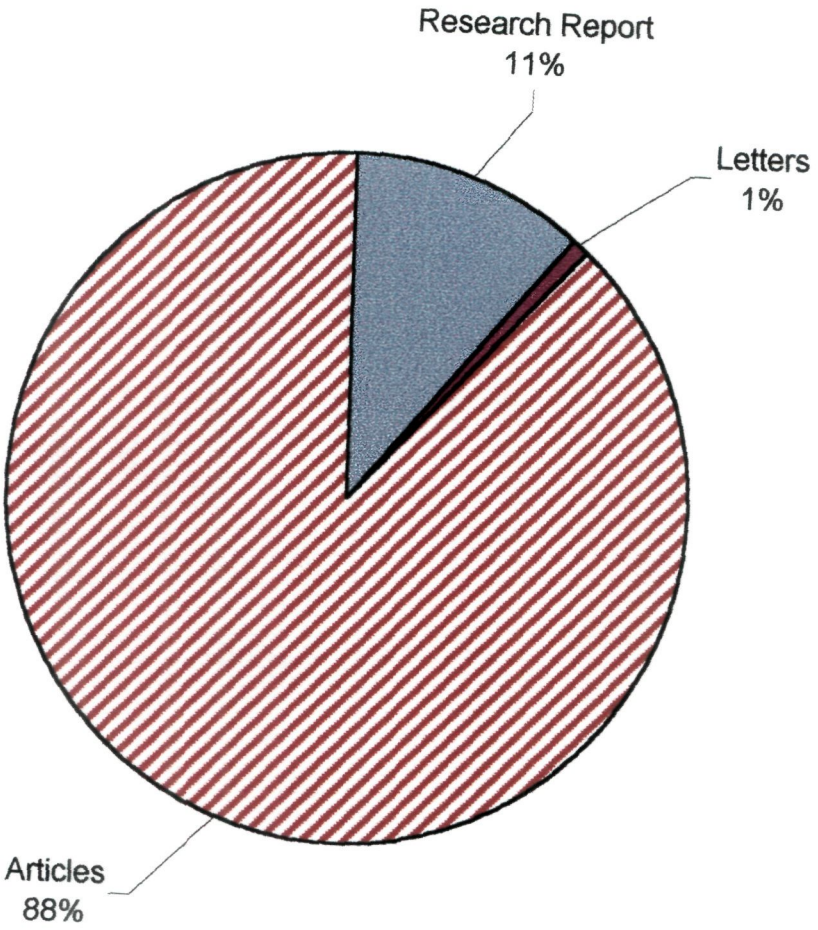
The analyzed data has thus, revealed that periodicals are the most dominant from in which literature on Metabolism is published.

Table - 5

Formwise Distribution of Items

S.No.	Name of the Form	Frequency Occurrence	Frequency Percentage	Cumulative Frequency Percentage
01.	Articles	4323	87.28	87.28
02.	Research Reports	529	10.68	97.96
03.	Letters	42	0.84	98.30
04.	Conference Proceedings	34	0.68	99.48
05.	Reviews	19	0.38	99.86
06.	Bulletins	06	0.12	**99.98**
	TOTAL	**4953**	**99.98**	

FORMWISE DISTRIBUTION



6. SUBJECTWISE DISTRIBUTION

It is a common experience that most of the material on a given subject appears in certain core journals. However, it is not hard to find some relevant articles getting scattered in some other journals not exactly belonging to the subject. This analysis has been done, on the basis of subject field of periodicals publishing the literature. The subject field of the periodicals were found out by the help of Ulrich International Periodical Directory (35th ed.).

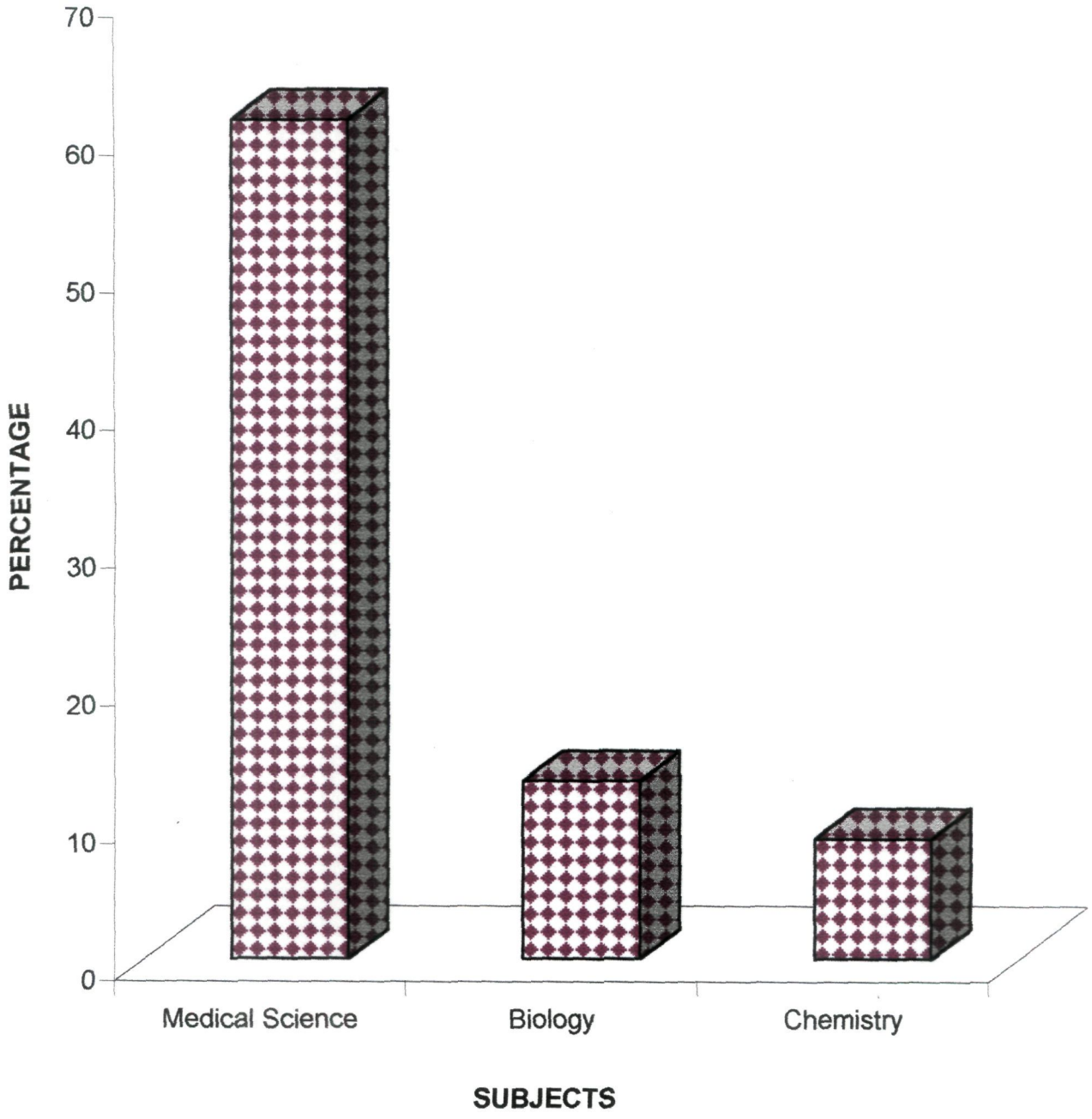
As shown in Table 6, the total number of 4953 items appear in 845 journals belonging to 9 different subjects areas. Medical Science occupied the first rank with 3016 citations, 60.89% of total. Second position is held by Biology, in which the frequency is 12.88% followed by chemistry with 8.68% and Biotechnology with 5.83%; Biochemistry with 4.96% and Zoology with 2.58%. The other disciplines in which one or less than one percent of total items appear are Agriculture, Biophysics and Botany.

Table – 6

Subjectwise Distribution of Items

S. No.	Subject Area	Frequency Occurrence	Frequency Percentage	Cumulative Frequency Percentage
01.	Medical Science	3016	60.89	60.89
02.	Biology	638	12.88	73.77
03.	Chemistry	430	8.68	82.45
04.	Biotechnology	289	5.83	88.28
05.	Biochemistry	246	4.96	93.24
06.	Zoology	128	2.58	95.82
07.	Agriculture	84	1.69	97.51
08.	Biophysics	68	1.37	98.88
09.	Botany	49	0.82	99.70
10.	unknown	5	0.10	**99.80**
	TOTAL	**4953**	**99.80**	

SUBJECTWISE DISTRIBUTION



7. RANKING OF AUTHORS

In every subject certain authors distinguish themselves by way of their contribution. It is therefore, important to study the scientists who have contributed most in the subject. This information is useful for the librarians as well as the users.

For the purpose, three categories of authors viz. single author, two authors and multiple authors were taken into account.

From the data presented in table 7, it follows that 622 items (12.55%) were contributed by single authors, 987 items (19.92%) by two authors, and 3344 items (67.51%) by more than two authors. It can, therefore, be inferred that the modern trend of research in the field of Metabolism is joint authorship, involved to complete a research project.

In the table the top three eminent authors are :-

1. Yamamoto, D. 25 times
2. Sato, Atsushi 19 times
3. Yoshida, S. 18 times

Table - 7

Ranking of Authors

Sl.No.	Rank	Name of the Authors	Frequency
1	1	Yamamoto, D.	25
2	2	Sato, Atsushi	19
3	3	Yoshida, S.	18
4	4	Nakagawa, Y.	17
5	5	Cinaz, Peyami	15
6	5	Ruskin, P.	15
7	5	Satio, Maiko	15
8	5	Sun, Ming	15
9	6	Dunkerson, D.D.	14
10	6	Ikeda, T.	14
11	6	Pappas, Peter W.	14
12	7	Anderson, Henrik	13
13	7	Tanaka, E.	13
14	7	Walsh, K.B.	13
15	8	Benevenga, N.J.	12
16	8	Boden, Guenther	12
17	8	Carroll, K.K.	12
18	8	Dabrowska, E.	12

Sl.No.	Rank	Name of the Authors	Frequency
19	8	Jacques, H.	12
20	8	Karowe, David N.	12
21	8	Lieber, Charles S.	12
22	8	Miyamura, T.	12
23	8	Okada, S.	12
24	8	Siemens, David H.	12
25	8	Tanaka, K.	12
26	8	Tanahashi, T.	12
27	8	Thrope, M.R.	12
28	9	Bailey, James E.	11
29	9	Dudley, Robert	11
30	9	Filenz, Mariaune	11
31	9	Fujikowa, S.	11
32	9	German, J.B.	11
33	9	Goodwin, Gary W.	11
34	9	Hannestad, U.	11
35	9	Kinoshita, M.	11
36	9	Luis, A.	11
37	9	Pahlsson, P.	11
38	9	Pereira, N.	11

Sl.No.	Rank	Name of the Authors	Frequency
39	9	Taylor, Christopher S.	11
40	9	Voigt, Christian	11
41	9	Winter, York	11
42	9	Yamanouchi, K.	11
43	10	Demonty, I.	10
44	10	Haddab, L.	10
45	10	Hamada, N.	10
46	10	Heisler, N.	10
47	10	Karth, V.N.R.	10
48	10	Liang, Yi-Qiang	10
49	10	Luettge, U.	10
50	10	Matiz, M.F.	10
51	10	Muto, T.	10
52	10	Ueda, S.	10
53	11	Brabant, G.	9
54	11	Chausson, F.	9
55	11	Chin, N.M.	9
56	11	Coumans, A.B.C.	9
57	11	Ganter, M.	9
58	11	Ikeda, Y.	9

Sl.No.	Rank	Name of the Authors	Frequency
59	11	Iriyama, Aiko	9
60	11	Johnson, S.B.	9
61	11	Kakumu, S.	9
62	11	Kawaguchi, Y.	9
63	11	Larsson, S.	9
64	11	Manahan, D.T.	9
65	11	Marsh, A.G.	9
66	11	Nakagami, T.	9
67	11	Ookuma, M.	9
68	11	Suzuki, S.	9
69	11	Takahama, Umeo	9
70	11	Tuschy, I.	9
71	11	York, D.A.	9
72	12	Coskun, P.E.	8
73	12	Franken, D.B. Ariatti	8
74	12	Gannon, M.C.	8
75	12	Gershanovich, V.N.	8
76	12	Kim, W.S.	8
77	12	Kubrak, M.	8
78	12	Roberts, R.S.	8

Sl.No.	Rank	Name of the Authors	Frequency
79	12	Roman, Christine	8
80	12	Tatsuno, Y.	8
81	12	Thomas, M.C.	8
82	12	Ushi, Kuniko	8
83	12	Zhang – Cheng, Z.	8
84	13	Harris, W.S.	7
85	13	Hassan, G.	7
86	13	Henze, P.	7
87	13	Hultberg, B.	7
88	13	Hoffner, S.M.	7
89	13	Hofekamp, K.E.	7
90	13	Itoh, Takao	7
91	13	Katz, R.	7
92	13	Kim, Hung	7
93	13	Lambert, Anne	7
94	13	Mathieu, Michel	7
95	13	Mauget, R.	7
96	13	McCullagh, K.J.A.	7
97	13	Nakagawa, Yoshinao	7
98	13	Orsetti, A.	7

Sl.No.	Rank	Name of the Authors	Frequency
99	13	Parker, D.S.	7
100	14	Anderson, Wagne H.	6
101	14	Avellini, Luca	6
102	14	Barber, Teresa	6
103	14	Bothast, R.J.	6
104	14	Celma, M.L.	6
105	14	Cox, Diane W.	6
106	14	Danfaer, A.	6
107	14	Dorchy, H.	6
108	14	Ferrer, Juan	6
109	14	Gupta, S.	6
110	14	Hansen, J.E.S.	6
111	14	Hayakawa, Hiroshi	6
112	14	Hunter, J.K.	6
113	14	ITO, H.	6
114	14	Jacobson, E.L.	6
115	14	Janssen, P.H.	6
116	14	Jawel, Asrar	6
117	14	Kirwan, John P.	6
118	14	Lambert, I.H.	6

Sl.No.	Rank	Name of the Authors	Frequency
119	14	Melov, Simon	6
120	14	Murphy, Denis J.	6
121	14	Nyhus, K.J.	6
122	14	Palmer, C.L.	6
123	14	Perrotta, S.	6
124	14	Piper, Peter	6
125	14	Ulghi, L.	6
126	14	Unden, G.	6
127	14	Verson, Benoit	6
128	14	William, D.	6
129	15	Auwan, Johan	5
130	15	Bennett, C.N.	5
131	15	Bessman, S.P.	5
132	15	Block, Mats Part	5
133	15	Cascnte, M.	5
134	15	Chappell. M.A.	5
135	15	Charles, J.	5
136	15	Coleman, R.A.	5
137	15	Fransson, Ake	5
138	15	Ghodsi, Abdi	5

Sl.No.	Rank	Name of the Authors	Frequency
139	15	Gottesman, Susan	5
140	15	Guillot, E.	5
141	15	Hass, Richard, H.	5
142	15	Hoffman, W.H.	5
143	15	Joseph, S.	5
144	15	King, R.R.	5
145	15	Ledgard, S.F.	5
146	15	Legrand, P.	5
147	15	Mortimer, K.A.	5
148	15	Nielsen, P.H.	5
149	15	Samson, Steven C.	5
150	15	Saxena, D.	5
151	15	Srivastava, S.	5
152	15	White, B.A.	5
153	15	Zabot, M.T.	5
154	16	Arias, I.M.	4
155	16	Aubora, Karen	4
156	16	Barron, M.C.	4
157	16	Bekes, F.	4
158	16	Bernard, L.P.	4

Sl.No.	Rank	Name of the Authors	Frequency
159	16	Bittolo, Gabriele	4
160	16	Burns, C.P.	4
161	16	Clemens, S.	4
162	16	Colombo, C.	4
163	16	Da Silva, J.R.G.	4
164	16	Edelman, S.	4
165	16	Evans, M.	4
166	16	Fleming, H.P.	4
167	16	Fliesler, Steven J.	4
168	16	Frerman, L.	4
169	16	Gournay, Veronique A.	4
170	16	Greger, J.L.	4
171	16	Gruber, A.	4
172	16	Guirand, P.	4
173	16	Horowitz, M.	4
174	16	Kellum, J.A.	4
175	16	Larsen, Eloise J.	4
176	16	Lawler, James P.	4
177	16	Maffeis, C.	4
178	16	Mc. Donald, J.R.	4

Sl.No.	Rank	Name of the Authors	Frequency
179	16	Moore, Mary Courtney	4
180	16	Muller, H.L.	4
181	16	Nelson, R.P.	4
182	16	O'Connor, B.	4
183	16	Paojunen, Hannu	4
184	16	Poh, C.L.	4
185	16	Rado, J.P.	4
186	16	Reves, R.	4
187	16	Royer, L.	4
188	16	Ruhland, Monita	4
189	16	Saraiva, M.J.M.	4
190	16	Smith, N.A.L.	4
191	16	Subramanyam, M.V.	4
192	16	Sulman, R.G.	4
193	16	Strack, D.	4
194	16	Van Griensven, Martiju	4
195	16	Vargo, S.I.	4
196	16	Viviana, A.	4
197	16	Wainman, B.C.	4
198	16	Walshe, J.M.	4

Sl.No.	Rank	Name of the Authors	Frequency
199	16	Weber, J.M.	4
200	16	Wegener, Garhard	4
201	16	Zenk, M.H.	4
202	17	Abbott, Frank S.	3
203	17	Andros, L.S.	3
204	17	Astorri, E.	3
205	17	Barrett, P.H.R.	3
206	17	Bazim, J.E.	3
207	17	Beaufrere, B.	3
208	17	Breidenbach, A.	3
209	17	British Hyperlepidemia Association	3
210	17	Brookes, Pauls	3
211	17	Bulow, Leif	3
212	17	Callingwood, A.	3
213	17	Cheng, Christine	3
214	17	Collin, R.G.	3
215	17	Curtiss, L.K.	3
216	17	Dang, Chi V.	3
217	17	Douglas, A.E.	3
218	17	Duchesne, A.	3

Sl.No.	Rank	Name of the Authors	Frequency
219	17	Emri, Thomas	3
220	17	Feldman, David	3
221	17	Fernandez, Katherine	3
222	17	Field, A.C.	3
223	17	Freeze, Hudson H.	3
224	17	Gesma, D.	3
225	17	Gibbons, G.F.	3
226	17	Gildow, F.E.	3
227	17	Greenbera, R.S.	3
228	17	Guray, A.	3
229	17	Hartwing, V.A.	3
230	17	Hinkle, P.	3
231	17	Hoffer, L.J.	3
232	17	Honma, S.	3
233	17	Hope, Perdila J.	3
234	17	Horl, W.H.	3
235	17	Hulbert, A.J.	3
236	17	Iyer, R.	3
237	17	Jakobs, C.	3
238	17	Jensen, Michael D.	3

Sl.No.	Rank	Name of the Authors	Frequency
239	17	Kanada, Shogo	3
240	17	Kereme, Zohar	3
241	17	Knoess, Werner	3
242	17	Kontos, H.A.	3
243	17	Little, J.A.	3
244	17	Loreal, O.	3
245	17	Mann, G.E.	3
246	17	Marcolongo, P.	3
247	17	Mattoo, A.K.	3
248	17	Mautz, W.W.	3
249	17	Meloni, T.	3
250	17	Mezzetti, Andrea	3
251	17	Miller, S.G.	3
252	17	Muennich, A.	3
253	17	Nava, Eduardo	3
254	17	New Field, Liora	3
255	17	Paranhos, A.	3
256	17	Pincelli, A.I.	3
257	17	Pocsi, Istovan	3
258	17	Pownall, H.	3

Sl.No.	Rank	Name of the Authors	Frequency
259	17	Ribatta, Joseph	3
260	17	Richmonds, Chelliah R.	3
261	17	Ruggiu, G.	3
262	17	Sano, H.	3
263	17	Sebert, P.	3
264	17	Seekamp, Andreas	3
265	17	Singh, A.K.	3
266	17	Sonn, Judith	3
267	17	Stephen, J.	3
268	17	Stock, M.J.	3
269	17	Summers, Adam P.	3
270	17	Swanson, G.cM.	3
271	17	Winston, G.W.	3
272	18	Alasoglu, C.	2
273	18	Alberto, A.	2
274	18	Bakker, Onno	2
275	18	Basova, N.	2
276	18	Bergman, Brigitta	2
277	18	Bodin, P.	2
278	18	Brand, T.D.	2

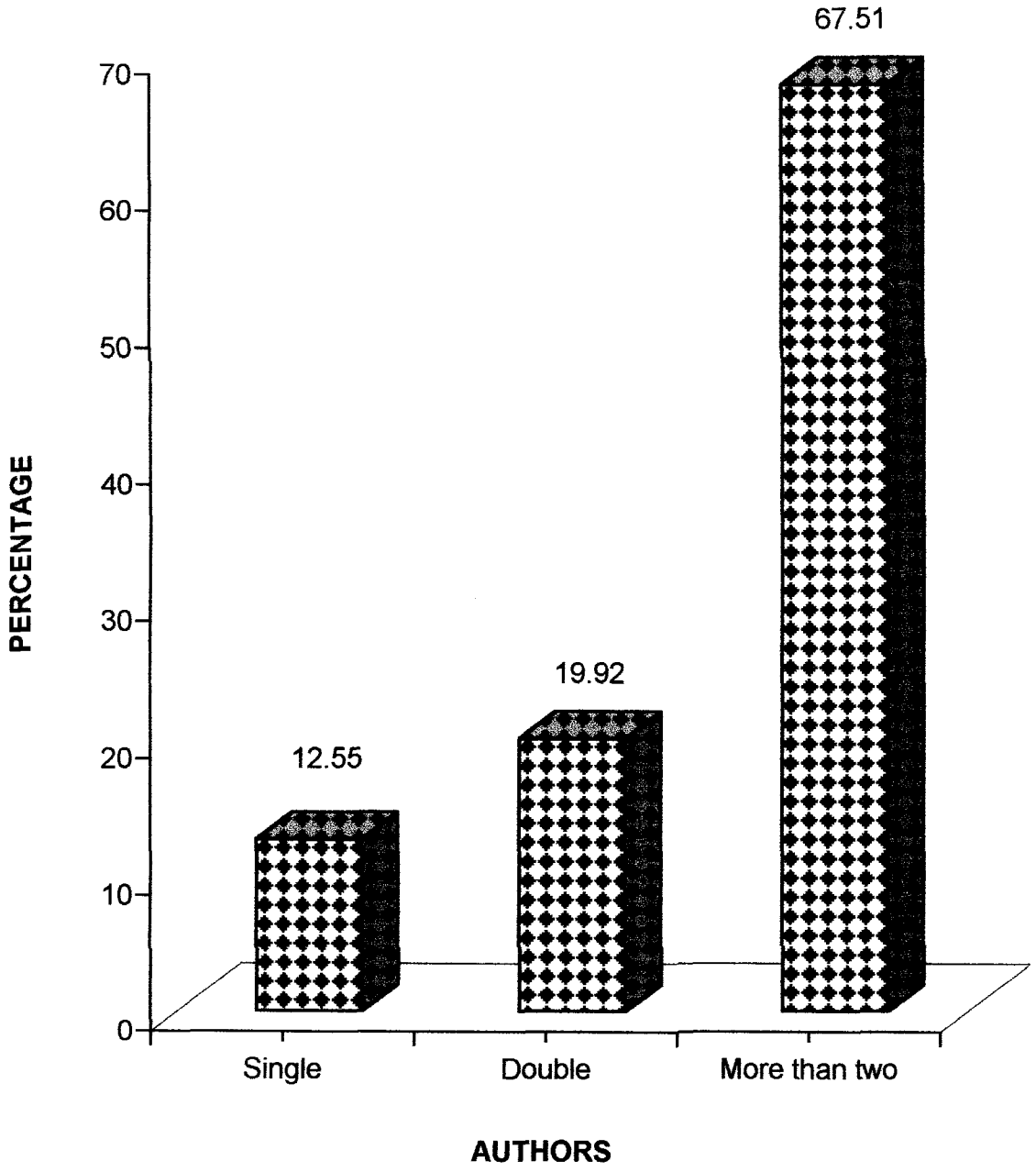
Sl.No.	Rank	Name of the Authors	Frequency
279	18	Bridges, Susan R.	2
280	18	Cacan, Rene	2
281	18	Campbell, Colin D.	2
282	18	Christopherson, R.J.	2
283	18	Curi, R.	2
284	18	Comic, L.	2
285	18	Costantini, Fubrizio	2
286	18	Dahm, J.	2
287	18	Dorege, Wulf	2
288	18	Edwards, R.	2
289	18	European Association for the Study of Obesity	2
290	18	Everhart, J.	2
291	18	Gomez, Casati	2
292	18	Gooday, G.W.	2
293	18	Harrison, L.C.	2
294	18	Hazra, S.	2
295	18	Heredia, A.	2
296	18	Honda, Misao	2
297	18	Hopper, Waheeta	2
298	18	Huang, James	2

Sl.No.	Rank	Name of the Authors	Frequency
299	18	Jensen, Kenneth A.	2
300	18	Keir, G.	2
301	18	Kimbal, K.T.	2
302	18	Kirchgessner, M.	2
303	18	Knight, C.H.	2
304	18	Leady, J.L.	2
305	18	Levo, Yorum	2
306	18	Maldonada, S.	2
307	18	Marecek, Zelenek	2
308	18	Marsh, K.	2
309	18	Martin, J.F.	2
310	18	Meier, Bernhard	2
311	18	Meilin, Mika	2
312	18	Mejia, G.D.	2
313	18	Mercier, M.	2
314	18	Minato, Kouichi	2
315	18	Molin, Sigal	2
316	18	Moon, D.H.	2
317	18	Mullol, J.	2
318	18	Newbold, C.J.	2

Sl.No.	Rank	Name of the Authors	Frequency
319	18	Nicklas, W.J.	2
320	18	Nicol, Dave	2
321	18	Orlandi, D.	2
322	18	Ovali, F.	2
323	18	Petersen, D.R.	2
324	18	Petrovic, V.M.	2
325	18	Pezza, M.	2
326	18	Piton, Annie	2
327	18	Pospesel, M.A.	2
328	18	Racey, P.A.	2
329	18	Reuss, J.	2
330	18	Roach, Peter J.	2
331	18	Rob, M.A.	2
332	18	Rueffer, Martina	2
333	18	Ruizhen, Ehene	2
334	18	Sack, K.	2
335	18	Sami, Laszlo	2
336	18	Schmidth, H.	2
337	18	Sears, C.E.	2
338	18	Sepkovic, D.W.	2

Sl.No.	Rank	Name of the Authors	Frequency
339	18	Sharma, S.G.	2
340	18	Shul'man, G.E.	2
341	18	Slamler, J.S.	2
342	18	Slymne, S.	2
343	18	Stewart, C.S.	2
344	18	Stumvoll, P.	2
345	18	Thompson, J.E.	2
346	18	Tressl, R.	2
347	18	Torrente, A.	2
348	18	U.K. Prospective Diabetes Study Group	2
349	18	Vederas, J.E.	2
350	18	Wang, Eren	2
351	18	Walia, B.N.S.	2
352	18	Whitelock, J.M.	2
353	18	Wild, J.R.	2
354	18	Winchester	2
355	18	Wootton, S.A.	2
356	18	Wratten, S.D.	2
357	18	Zhai, Lanmin	2
358	18	Zhao, J.	2

AUTHORSHIP PATTERN



APPPLICATION OF BIBLIOMETRIC LAWS

The next step after analysis and interpretation of data is to apply the bibliometric laws on the results obtained from analysis of collected data. The main purpose of the study is to check the validity of these laws.

Bradford's Law of Scattering

The Bradford's Law of Scattering states : "If scientific periodicals are arranged in order of decreasing productivity of articles on a given subject that may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and succeeding zones will be $1:n:n^2$".

In the formula $1:n:n^2$, '1' is the number of periodicals in the nucleus and 'n' is a multiplier.

This is the law of distribution, or Bradford's Law of Scattering.

On the basis of this law, 845 periodicals have been situated and divided into three groups according to their frequency of occurrence.

In the first zone 24 periodicals contained 1659 items, in the second zone 139 periodicals contained 1647 items and remaining 682 periodicals contained 1647 items in the third zone.

In other words, we can say that first 24 periodicals have covered 1/3 of the total items, next 139 periodicals have covered 1/3 items and 682 periodicals also covered yet another 1/3 items. For all this, data from **Table 3 Ranking of periodicals** has been taken into. This analysis clearly shows the phenomenon of scattering of items in different zones of journals.

The nucleus zone contains 24 journals, followed by 139 journals in second zone and 682 journals in third zone. The zones, thus identified, will form an approximately geometric series :

24 : 139 : 682

here 139 = 24 x 5 (Approx.)

682 = 24 x 5 x 5 (Approx.)

Therefore, 24 : 24 x 5 : 24 x 5x 5

Substitute 5 = n

We get 24 : 24 n : 24 n^2

Taking 24 as constant

We get 1 : n : n^2

(where 1 is number of journals in the nucleus and n is a multiplier).

Thus Bradford's Law is proved.

The number of journals in the nucleus can be obtained by plotting *f*(r) and log n on semi logarithmic graph paper (a bibiliograph), where *f*(r) is cumulative frequency and log n is log of rank of journals as shown in the graph. This graph is drawn with the help of data analysed and computed in **table 3.**

The log value of 24 journals in first zone is 1.380211242. The log value of 139 journals in second zone is 2.1430148. The log value of 682 journals in the third zone is 2.833784375.

Table - 8

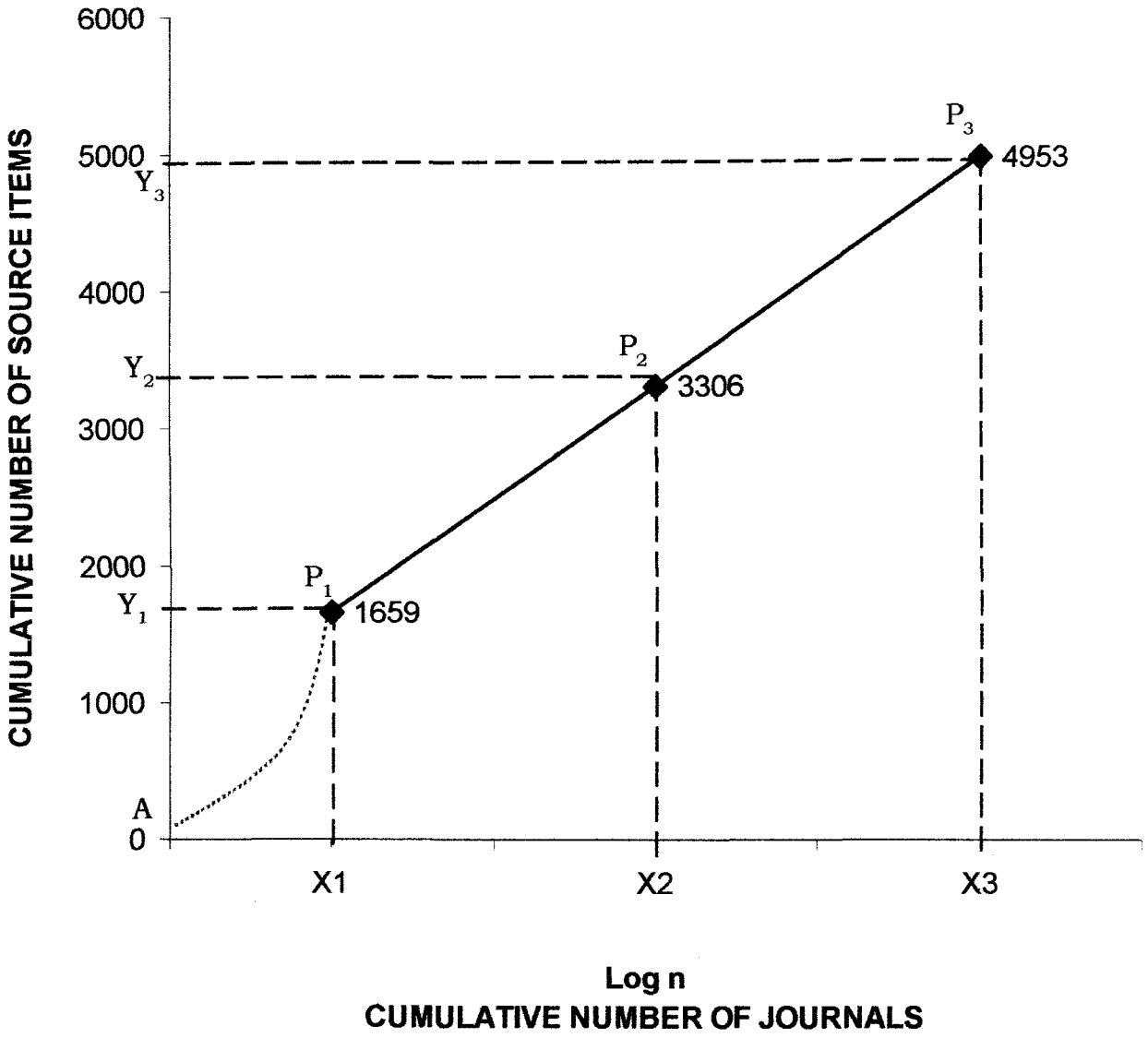
Bradford's Table

S. No.	No. of Journals	Cum. of Journals	Number of items	Cum. of Items.
1	1	1	228	228
2	1	2	141	369
3	1	3	136	505
4	1	4	99	604
5	1	5	97	701
6	1	6	96	797
7	1	7	90	887
8	1	8	67	954
9	1	9	61	1015
10	1	10	60	1075
11	1	11	57	1132
12	1	12	54	1186
13	1	13	52	1238
14	1	14	51	1289
15	1	15	44	1333
16	1	16	41	1374
17	1	17	40	1414
18	1	18	37	1451
19	1	19	36	1487
20	1	20	36	1523
21	1	21	35	1558
22	1	22	34	1592
23	1	23	34	1626
24	1	24	33	1659
			1659	

S. No.	No. of Journals	Cum. of Journals	Number of items	Cum. of Items.
25	4	28	109	1768
26	4	32	99	1867
27	4	36	96	1963
28	4	40	92	2055
29	6	46	122	2177
30	6	52	110	2287
31	6	58	101	2388
32	6	64	88	2476
33	8	72	103	2579
34	8	80	95	2674
35	8	88	86	2760
36	8	96	80	2840
37	10	106	99	2939
38	10	116	81	3020
39	11	127	80	3100
40	12	139	68	3168
41	12	151	72	3240
42	12	163	66	3306
			1647	

S. No.	No. of Journals	Cum. of Journals	Number of items	Cum. of Items.
43	10	173	80	3386
44	10	183	80	3466
45	20	203	102	3568
46	20	223	100	3668
47	20	243	110	3778
48	20	263	99	3877
49	30	293	120	3997
50	30	323	110	4107
51	30	353	86	4193
52	30	383	88	4281
53	50	433	72	4353
54	50	483	61	4414
55	50	533	109	4523
56	60	593	96	4619
57	60	653	95	4714
58	60	713	65	4779
59	60	773	99	4878
60	72	**845**	75	**4953**
			1647	

BRADFORD'S BIBLIOGRAPH



Taking log n on x – axis and taking number of items in each zone on y – axis, a graph was plotted. The bibliograph thus, obtained was found to be by and large, similar to Bradford's bibliograph, as the graph begins as a rising curve AP 1 and continues as a straight line. This rising part of the graph represents the nucleus of highly productive journals. The points P1, P2 and P3 on bibliograph are the boundaries of the three equiproductive zones in which almost the same number of articles as the nucleus (represented by 1 = Y1Y2 = Y2Y3) derived from an increasingly large number of journals (represented ox1, x1 x2 and x2 x3).

The Bradford's law is proved thus.

Zipf's Law

This law was put forth by George k. Zipf. The law states that, "In a long textual matter if words are arranged in their decreasing order of frequency, then the rank of any of occurrence in given word of the text will be inversely proportional to the frequency of occurrence of the word".

Formula :-

$$r \propto \frac{1}{f}$$

$$r = (\text{a constant}) \frac{1}{f}$$

$$rf = \text{a constant}$$

To apply this law, words were collected from the title and ranked according to their frequency of occurrence in decreasing order. Only those words occurring upto 45 times are listed in table 9.

On application of this, it was found that log of frequency of occurrence of words when added to log of

their rank, the result are almost same for each words as shown below :-

Word – Metabolism 642 times Rank 1

Log of Frequency + Log of Rank

Log 642 + Log 1

= 2.8075.

Word – Lipid 600 Times Rank 2

Log 600 + Log 2

= 3.0791

Word – Diabetes 519 Times Rank 3

Lot 519 + log 3

= 3.1922

An average of log C value, 3.19 was found. This finding varified the Zipf's Law.

Table - 9

Zipf's Table

S. No.	Rank	Word	Frequency	Log C Constant
1	1	Metabolism	642	2.8075
2	2	Lipid	600	3.0791
3	3	Diabetes	519	3.1922
4	4	Lipoprotein	412	3.2169
5	5	Hormone	344	3.2355
6	6	Enzyme	302	3.2581
7	7	Glucose	200	3.3252
8	8	Fatty Acids	160	3.1072
9	9	Insulin	141	3.1034
10	10	Methyl	110	3.0413
11	11	Hyperglycemia	96	3.0236
12	12	Blood	94	3.0523
13	13	Amino Acid	82	3.0277
14	14	Biosynthesis	79	3.0437
15	15	Cellulose	76	3.0569
16	16	Calcium	64	3.0102
17	17	Sucrose	61	3.0157
18	18	Carbohydrate	55	2.9956
19	19	Hydrocarbon	46	2.9415
20	20	Gluconeogenic	45	2.9542
21	20	Mutants	45	2.9545

Lotka's Inverse Square Law

This law states that, the number of scientists who contributed n papers will be $1/n^2$ of those who contributed only one paper. During the present analysis it was observed that 18,951 authors have contributed 4953 items. Out of 18,951 authors, only 358 authors have contributed more than one paper and rest 18,593 authors contributed only one paper. However, according to Lotka's Law, single contributors should account for 60% of the total.

Lotka's Law was applied to know the number of scientists contributing 2 papers, 3 papers and 4 papers respectively, as given below :-

I. ***Scientists Contributing 2 Papers*** : As we know that the number of authors contributing only one paper is 18,593.

Applying Lotka's Law, the number of scientists contributing only 2 papers may be collected by

the formula :

No. of Scientists publishing n paper

$$= \frac{\text{No. of Scientists publishing 1 paper}}{n^2}$$

$$= 18593 \times 1/2^2 = 4648$$

Thus, according to Lotka's Law, number of scientists publishing 2 paper should be 4648. However, an analysis of the collected data shows that only 87 authors have contributed 2 papers, which is far less than the 4648 figure, obtained by applying Lotka's Law.

II. ***Scientists Contributing 3 Papers*** :

By applying Lotka's Law

No. of Scientists publishing n paper

$$= \frac{\text{No. of Scientists publishing 1 paper}}{n^2}$$

$$= 18593 \times 1/3^2$$

$$= 18593 / 9 = 2065$$

An analysis of the data shows that 71 authors contributed 3 papers, which is far less than 2065.

III. ***Scientists Contributing 4 Papers*** :

Apply the formula :-

No. of Scientists publishing n paper

$$= \frac{\text{No. of Scientists publishing 1 paper}}{n^2}$$

$$= 18593 \times 1/4^2$$

$$= 18593 / 16 \qquad = 1162$$

The number of authors publishing 4 papers = 1162.

The analysis of collected data shows that only 49 authors have contributed 4 papers which is again far less than calculated figure 1162.

The above calculation shows that Lotka's Law does not hold good when applied to the current literature. It is probably due to the fact that the trend of research now-a-days has changed. The calculations given above, show – only 87 authors contributed 2 papers, 71 authors have contributed 3 papers and only 49 authors have

contributed 4 papers. The analysis clearly indicates that the trend of research in modern times is not the same as that of during Lotka's period. In the changed scenario Lotka's law needs re-examination.

Chapter - 5

Conclusion and Implications

CONCLUSION AND IMPLICATIONS

Bibliometrics is that branch of information theory that attempts to analyse quantitatively the properties and behaviour of recorded knowledge. Bibliometrics based on statistical analysis can be used for eliminating low-quantity literature and to select a small portion of significant reliable and relevant high quality publications.

The Bibliometric laws are empirically founded statistical distributions. They are not innate natural laws but essentially behavioural patterns of users and authors.

The knowledge phenomenon has led to the scattering of literature in various documents. The study was conducted to identify the distinguished characteristics of the literature on Metabolism. With the help of well established method of bibliometrics, the conclusion arrived at in this study and recorded below are based upon the evidence collected from Biological

Abstracts (1998-99). The main objectives of this bibliometric study are as follows :

To find out the individual contribution of significant authors and observe authorship pattern.

To find out the form of the document used in the subject field and their languages and countries of origin.

Compile a ranked list of journals and authors.

Observe chronological distribution and frequency of cited journals.

This is a method of showing, how rapidly material published by a journal are picked up and used.

In this the conclusion drawn is that the articles on the subject Metabolism were published in different journals published from different countries. The period of study is two years 1998-99, covering 4953 articles and more productive journals are 845.

From the countrywise study, it is found that USA, U.K., Japan, Germany are more productive countries in the Literature on 'Metabolism'.

Subjectwise distribution shows that 60.89% literature belongs to the subject field of Medical Science followed by Biology 12.88%, Chemistry 8.68%, Biotechnology 5.83% and so on. This analysis has been done on the basis of subject field of periodicals publishing the literature.

Languagewise distribution shows that most of the Literature in the field is published in English Language 93.49% while about 6.46% Literature is published in other languages. This study may help in the provision of the translation services.

Periodical publications play key role in the research work because they contain the latest information about current developments in any field of knowledge. The study regarding form wise distribution of items concludes that the most of the literature on the subject was published in form of articles. It is therefore important to identify the core journals on the subject. The study shows that out of total 845 journals the three most productive periodicals in the subject are :

1. ***Metabolism Clinical and Experimental, U.S.A. 228 times.***

2. ***Journal of inherited Metabolic Disease, U.S.A. 141 times.***

3. ***American Journal of Physiology, U.S.A. 136 times.***

With the increase in the collaborative research, there has been an increase in the number of scientific papers having more than one author, we found the most productive author in that subject. This information was found to be useful for librarians and users also. This study shows that 622 items were written by single authors. The three most productive authors are :

1.	***Yamamoto, D.***	***25 times***
2.	***Sato, Atsushi,***	***19 times***
3.	***Yoshida, S.***	***18 times***

We conclude that the users in the field of Metabolism are highly dependent upon the periodical literature, and the most of the literature on the subject has emerged from USA, U.K. and Japan. English is being the most dominant language in written scientific

communication. All these three studies are based on Bibliometrics laws.

The results of the study are of great value to the librarians in planning and making policy decision with special reference to collection development, storage and weeding out less important journals.

Based on the analysis, the collected data were testified to show the validity of Bibliometric Laws. Of the three laws, only Lotka's law could not be verified as it seems to be out-dated at least in so far as the literature on Metabolism is concerned.

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